THE AEROPLANE and ASTRONAUTICS

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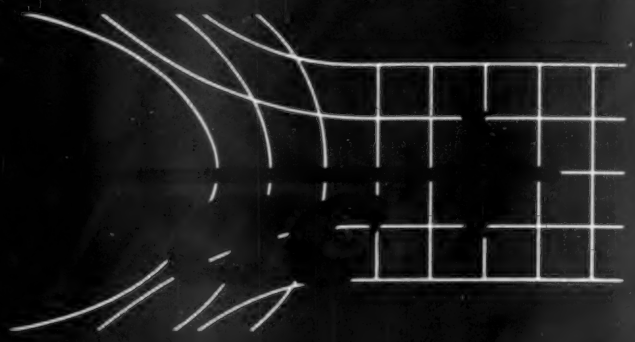

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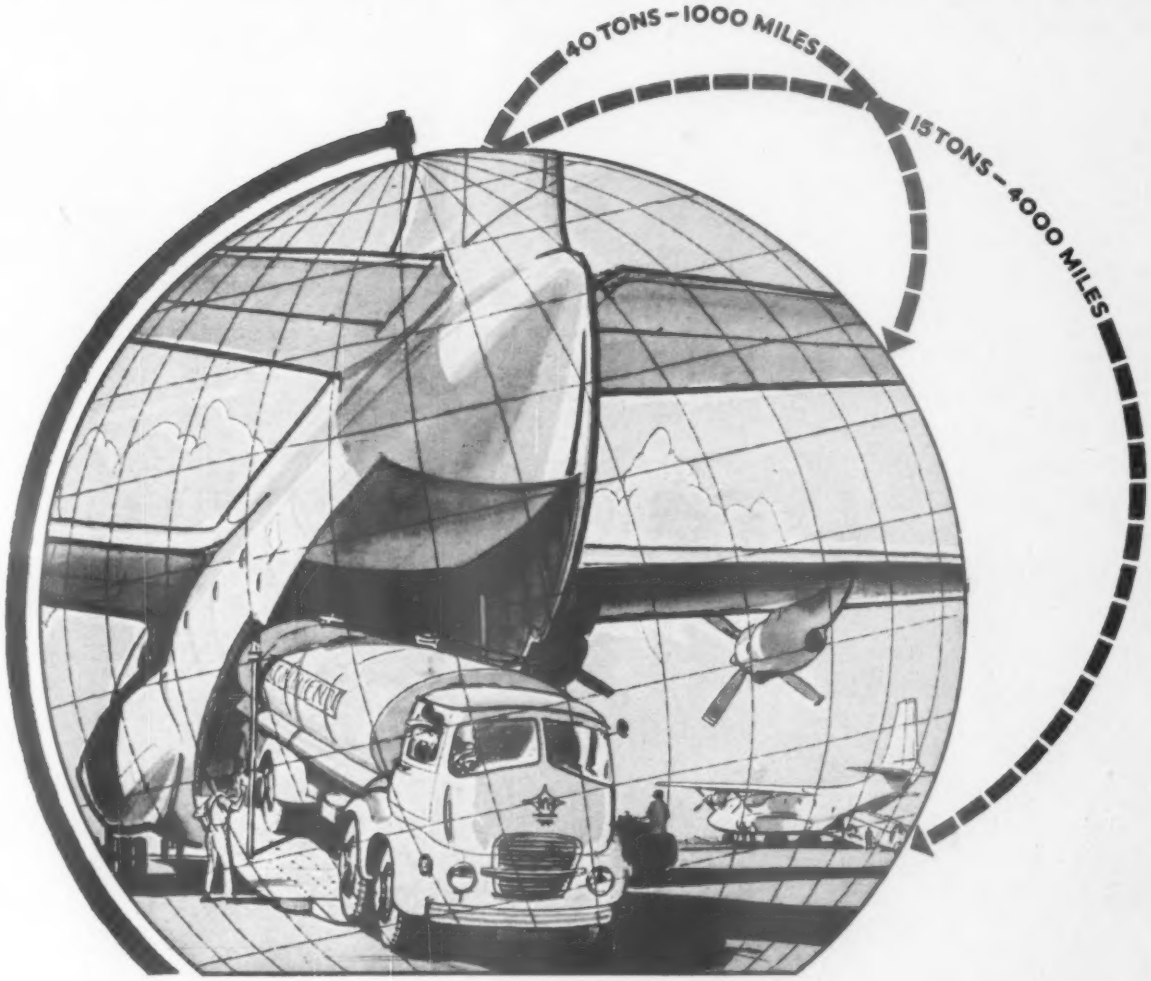

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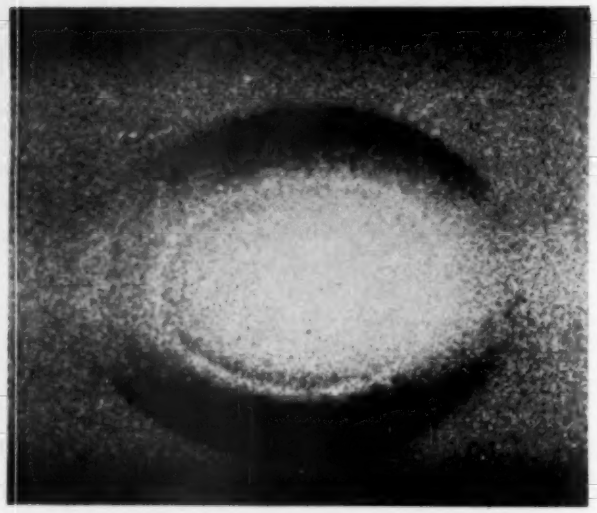

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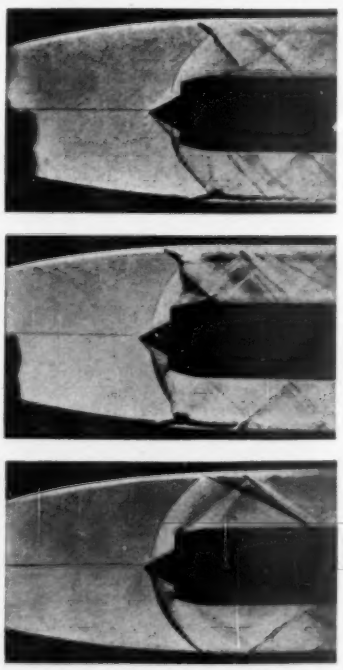

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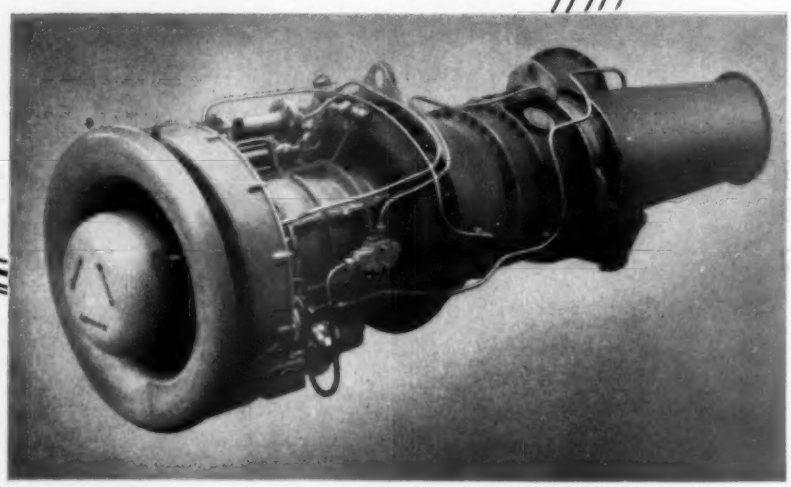

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2528 APRIL 1, 1960

Flying on Air

Last week Sir Roy Fedden, indefatigable as ever in his campaign for a "Finletter Report," wrote a letter to *The Daily Telegraph*. One point he raised concerned the potentialities of the market for light commercial aircraft. The making of these, he argued, cannot be left to the big aircraft or engine makers; he considers that the problem must be tackled by two specialist concerns, one for aircraft and one for engines.

He did not specifically define light commercial aircraft. A number of people are concerned about the paucity of competition from this country in the so-called light aircraft market, but there are a few concerns working hard along conventional lines, particularly with plywood and spruce.

So far there have been no reports of anyone attempting to make use of the latest pneumatic structural techniques. Examples have been built in this country and in the United States of inflated-structure aircraft. We have yet to hear of anyone profiting by recent work at Cardington. Mr. Dan Perkins of that establishment has succeeded in making a wing of high aspect ratio and 45-ft. span, able to carry a wing-loading of 2 lb. per square foot for a structure weight of 25 lb. This he described in a talk to the Royal Aeronautical Society last week. Here is a development in which this country is ahead. What is going to be done about it?

Concerted Action Against Noise

As air traffic intensifies during the lengthening days ahead we can be sure that the number of letters written to manufacturers, operators, Government departments and Members of Parliament, to complain about noise will greatly increase. And this must be expected, for not only do the aircraft now coming into service have increased power, but their characteristics are such that areas of the country, hitherto unaware of airliners, will be made regularly aware of them during their approach and departure from our international airports.

Noise is something which cannot be explained away. But explanation on the widest scale is necessary. It is necessary because public understanding and backing have to be won to support effort on a national scale to tackle the problem. So far as we can see the only way to inform the people who live around our cities of the nature of the problem and what the aeronautical engineer is doing to counter it, is by means of a widespread public relations campaign.

Following this, a vigorous Government attack, by means of research and development, on noise from aircraft could be expected to receive widespread support. Aeronautical engineers know the magnitude of the task to introduce silence into flying operations. They need all the encouragement available, both moral and financial, to aid them in the tremendous undertaking to defeat noise. No "breakthrough" can be expected from a small backroom. Suppression of noise calls for large-scale co-ordinated effort. It is certain to be one of the problems which will be accentuated by the introduction of VTOL aircraft.

The time seems to be ripe for the various aeronautical organizations to get together on the first stage of the problem: to win public support for an extensive programme of research and development into the suppression of aeronautical noise.

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Matters of Moment

Changes at Bristol

AS a preliminary step towards the closer integration of Bristol Aircraft, Ltd., into the new Vickers/English Electric/Bristol combine, to be known as the British Aircraft Corporation, some important changes have been made in the company's board of directors, and at executive level.

Rear Admiral Sir Matthew Slattery and Mr. P. G. Masefield have resigned from the board and relinquish their appointments as chairman and managing director respectively. Sir Reginald Verdon Smith becomes chairman.

Dr. A. E. Russell, hitherto director and chief engineer, has been appointed technical director; Mr. J. F. Harper, assistant managing director, becomes director and general manager. Two new appointments to the board are those of Mr. D. J. Farrar, who becomes chief engineer, guided weapons; and Dr. W. J. Strang who has been appointed chief engineer, aircraft.

Another executive appointment, but not to the board, is that of Mr. H. Giddings, hitherto assistant chief engineer. He now becomes chief development engineer.

Following these changes, the board of Bristol Aircraft will be: Sir Reginald Verdon Smith, chairman; Mr. C. F. Uwins; Mr. J. F. Harper, general manager; Dr. A. E. Russell, technical director; Mr. R. S. Brown, works director; Mr. W. R. Farnes, sales director; Mr. G. E. Knight, commercial director; Mr. T. B. Pritchard, financial director and secretary; Mr. D. J. Farrar, chief engineer, guided weapons; and Dr. W. J. Strang, chief engineer, aircraft.

Sir Matthew Slattery will remain a director of the Bristol Aeroplane Co., Ltd., which retains a holding in Short Brothers and Harland, Ltd., of which he is chairman and managing director. Dr. A. E. Russell has retired from the Bristol Aeroplane board in order to concentrate exclusively on the affairs of Bristol Aircraft, Ltd.

To Power the Supersonic Airliner

ACCORDING to Dr. R. R. Jamison and Mr. R. J. Lane of Bristol Siddeley Engines, for the Mach 2 airliner the best powerplant is a high-temperature turbojet with a high pressure ratio. At Mach 3 there is close competition between reheated turbojets and the combined turbojet-ramjet powerplant. At Mach 4.5 the combination engine has a clear lead.

These conclusions were reached in a paper read before the Royal Aeronautical Society on Mar. 24. Entitled "Engines for Supersonic Airliners," it came only a week after Mr. M. B. Morgan's classic R.Ae.S. lecture on the prospects and problems of supersonic transports (THE AEROPLANE AND ASTRONAUTICS for Mar. 25).

The evaluation of four types of powerplant applied to airliners cruising at speeds of Mach 2, 3 and 4.5, is described in the paper by Dr. Jamison and Mr. Lane. The engines were: unreheated turbojets with turbine entry temperatures up to 1,400°K; turbojets reheated up to 1,800°K; turbojets in combination with ramjets; and reheated ducted fans. At each speed and for each engine the engine/airframe combination was optimized; operation was considered over the transatlantic route.

Relative merits of each powerplant were shown by the percentage of the all-up weight available as payload. The best payloads were 15% at Mach 2, 12% at Mach 3 and 10% at Mach 4.5, with the engines mentioned.

If take-off noise were held to a minimum, the authors considered that the ducted fan with reheat in the cold-flow duct might offer competitive payloads. Another important factor which affected payloads was the height at which the aircraft exceeds Mach 1. If transonic acceleration were permissible below 36,000 ft., a greater payload could be carried.

In the discussion MR. M. B. MORGAN said that the payloads quoted appeared high; he believed that at Mach 2 the designer was doing well to approach 10% of the all-up weight, and not 15% as quoted. Dr. Jamison replied that the engines considered used really advanced techniques and that optimization gave very good matching. Spot points for British and U.S. projects checked fairly well with the Bristol Siddeley calculations.

MR. A. N. CLIFTON, of Vickers-Armstrongs, said that the 10-15% payload was of the same order as the weight growth customary with aircraft designs. He had also known engines to come out heavy and to use a little more fuel than specified. But in the past the engine people had been able to put the power up faster than the weight growth and thus to save the situation. With supersonic aircraft, he said, increases in power would

PRESENTATIONS. — At the Royal Aero Club last week, Lord Brabazon presented the Britannia Trophy to No. 111 Squadron R.A.F. Left, Sqn. Ldr. P. Latham expresses the Squadron's appreciation. The Geoffrey de Havilland Trophy went to Sqn. Ldr. R. Gellatly (below); and the R.Ae.C. Silver Medal to Major T. W. Willans. Dr. J. A. J. Bennett was to have been presented with the Louis Breguet Memorial Trophy but he is in hospital and will receive his trophy later.

Photographs copyright "The Aeroplane and Astronautics"

LARGE LOAD.—An eight-ton load of electronic equipment for the new guided weapons range in the Hebrides was recently transported from London Airport to Benbecula in an Armstrong Whitworth Argosy. Of the 30 cases involved the largest measured about 10 ft. x 4 ft. x 5 ft. 6 in.

Photograph copyright "The Aeroplane and Astronautics"

put the engine noise up. If this were not permissible, what would the engine designer keep up his sleeve?

Dr. Jamison replied that he knew of some cases where the aircraft had won this weight-thrust contest. It would certainly be difficult to put up thrust at sea level without noise increasing. But during the cruise ramjets would help, because their thrust could be increased by higher-temperature operation with little effect on the s.f.c.

MR. G. H. LEE of Handley Page queried the aspect ratios chosen in the lecture, which were 2 for the Mach 2 aircraft, 1½ for the Mach 3 transport and 1 at Mach 4.5. These, he felt, were rather high for the best results.

Manpowered Aircraft Design

A LECTURE was given on Mar. 25 before the Manpowered Aircraft Group of the R.Ae.S. by Mr. Dan Perkins. He told his hearers of the thinking behind the design of his high-wing 45-ft.-span monoplane and was frank in disclosing details of its inflated fabric construction. He was equally frank about the snags encountered by himself and his partner Alan Lock. He disclosed how tantalizingly close they had been to getting their machine airborne.

What Mr. Perkins did not get around to discussing is when he will be ready to make his next attempt. No doubt there are various other competitors for the Kremer £5,000 prize who would very much like to know just that.

Next week we shall publish an article exclusively written by Mr. Perkins for THE AEROPLANE AND ASTRONAUTICS in which he discusses the successful application of inflated-fabric construction to the building of light aeroplanes able to fly on 6 h.p. and which can be bundled up for transport by car with less trouble than a folding boat.

Aviation in Parliament

JUST what will Fylingdales be able to distinguish? MR. WILLIAM TAYLOR, the Under Secretary for Air, devoted some little time to this in his speech in the debate on the missile warning station on Mar. 25. There had been a suggestion, in a newspaper article, that the station would be unable to distinguish accurately between ballistic missiles at a distance of 2,000 miles and the trails of ionization left by meteors or between missiles and artificial satellites. Mr. Taylor declared that these conclusions were not borne out by the scientists who had advised the Government on this.

"I am told," he said, "there is no difficulty in distinguishing between ballistic missiles and artificial satellites since only during the limited period when a satellite is being put into orbit is there any resemblance between the latter's course and a ballistic course such as would be followed by a missile. The possibility of confusion between a missile trajectory and an ionization trail is so remote that for practical purposes it can be ignored."

Who said that unnecessary noise at R.A.F. West Malling was caused by incompetent flying?

Whoever it was, he was rebuked by MR. GEORGE WARD, the Air Minister, on Mar. 23. It all arose out of a question by MR. GEOFFREY DE FREITAS, Labour's Shadow Air Minister, as to how many complaints there had been of unnecessary noise caused by aircraft there. There had, said Mr. Ward, been a number of letters from people living nearby. The squadron's essential training programme was bound to cause some disturbance, "but we do all we can to keep this to a minimum." He hopes that when the Javelins move away from this airfield in the autumn, the main cause of the complaint will be removed.

Mr. de Freitas followed this up by a staunch defence of the R.A.F., commenting that unsubstantiated remarks about "incompetent flying" were very much resented in the R.A.F. "I quite agree," replied Mr. Ward. "The pilots of this squadron are highly skilled and experienced. I recognize that there is a real problem of disturbance at the moment, but matters are not helped by allegations of that kind."

Chalgrove Airfield is causing a little flutter, and Mr. Ward was asked by MR. JOHN HALL (Cons., Wycombe) why it had been sold to its present occupiers, the Martin-Baker Aircraft Co., Ltd., and not offered back to the previous landowners.

Mr. Ward replied that Chalgrove is surplus to needs, but the Government consider it essential to the very important work carried on by Martin-Baker, and had therefore decided to sell it to the company. He denied any resemblance to Crichel Down. The latter involved the transfer of land from a Department with compulsory powers to another Department which did not exercise such powers for the purpose of State management of land.

Chalgrove was a sale to a firm which was carrying out important defence work—"the work of this company has so far saved no fewer than 331 lives of R.A.F. pilots and aircrew."

There is to be a special debate on the adjournment.

Fares—Mr. Sandys hopes to make an announcement as soon as possible in respect of outstanding applications for low fares by the Air Corporations and independent operators. The delay, he says, is due to the fact that he has to consult some colonial and Commonwealth authorities on the IATA traffic conference results.

MR. RUSSELL (Cons., S. Wembley) thinks that the small allowance of duty-free cigarettes and spirits allowed on British airlines is working against us in competition with others.

Mr. Amory, the Chancellor, said that the limit applied equally to both British and foreign aircraft—to which Mr. Russell replied that foreign airlines could obtain greater quantities from stores abroad. Why not change the regulations? Mr. Amory, as might be expected, thought the allowances "very generous" and made on the basis that all the seats in the aircraft would be filled and that all the passengers would buy.—

PARLIAMENTARIAN.

Forthcoming Appointments

BRISTOL'S announcement of the resignation of the chairman and managing director from the board of Bristol Aircraft, Ltd., has set going, as was only to be expected, a good deal of speculation about the future of Sir Matthew Slattery and Mr. Peter Masefield.

The former remains on the board of the Bristol Aeroplane Company and is, of course, chairman and managing director of Short Brothers and Harland, Ltd. His name, however, is being talked of in connection with a successor to Sir Gerard d'Erlanger, who has told the Minister that he does not wish to continue as chairman of B.O.A.C.

Mr. Masefield has stated categorically that he has no plans yet fixed for the future, though powerful friends have, it must be noted, put him forward as candidate for the chairmanship of the new Air Transport Licensing Board.

Mr. Masefield has increased his international stature by the fine job he is doing as president of the Royal Aeronautical Society. Everyone will hope that he is not destined to follow the lonely path of another eminent Fellow and ex-president of the R.Ae.S., Sir Roy Fedden, who resigned as chief engineer at Filton in 1942.

Navigation Break-through?

THE future of hyperbolic and other radio navigation systems may have been modified significantly by the new Decca Omnitrac, some details of which were given early this week. By a "manipulation of mathematics" Decca have developed a small computer of sufficient accuracy to convert receiver outputs and decometer readings into position fixes on an undistorted grid.

The direct correlation of hyperbolic fixes with those from other position-fixing systems thus opens up the possibility of an undistorted pictorial navigation display for the flight deck and of automatic track-following devices.

Decca are now in the process of producing the first model of the new digital computer in airborne form and claim that this will have a fraction of the complexity of its predecessors and will have a large number of different applications in fields other than air navigation.

Fokker-Republic Co-operation

FOKKER will be in a position to offer a VTOL aircraft designed for NATO needs as a result of a recent agreement made by the Dutch company with Republic Aviation Corporation. Republic is to acquire "a substantial minority interest" in Fokker, and the two companies have agreed upon a joint programme for future co-operation.

Republic has spent $2½ million on research into VTOL aircraft, and the results of this research are to made available to Fokker. In this way, Republic obviously stands a better chance of obtaining a share in NATO orders than would be possible with a U.S.-produced design. Any Fokker projects resulting from this arrangement will, presumably, be in competition with the Hawker P.1127 and the Messerschmitt VTOL design powered by Rolls-Royce RB153 turbojets.

Another significant result of the agreement is that Fokker will become responsible for the support of the Republic F-105D Thunderchief, soon to be deployed in large numbers to the USAFE wings in Europe. Overhaul, repair, modification and production of ground-support equipment will be among Fokker's responsibilities in this respect. A portion of the current U.S. and European spares production for the large NATO inventory of F-84s may also be transferred to Fokker.

The Dutch company will remain "unilaterally responsible" for the F-27 Friendship and for work on such military programmes as the F-104G Starfighter (see p. 403-4), the Breguet 1150 Atlantic and the Hawk missile, as well as further developments in the civil and military aviation field.

Matters of Moment . . . .

Britain in Vienna

AVIATION was chosen as the theme for the British Pavilion at the International Spring Trade Fair for 1960 held in Vienna last month. Primarily this was with the object of making Austrians and Austrian industry more air-minded than with any immediate prospect of receiving major orders. The British Embassy in Vienna had succeeded very well in its efforts to persuade British concerns to attend the Fair—the majority of senior aircraft companies were exhibiting.

The interior of the British Pavilion was styled to give the impression of a hangar. As an eye-catching exhibit at its entrance, and mounted to give the appearance of a figurehead for the British exhibits, was a complete Prospector of the Lancashire Aircraft Company.

Hawker Siddeley Aviation were exhibiting for the first time since de Havilland and Blackburn joined party with them and among other models displayed were those of the Dove and NA.39. In contrast, the two engine companies associated with Hawker Siddeley were exhibiting individually—Bristol Siddeley Engines with a Proteus 765, a Viper ASV.11 and an Orpheus 803, and de Havilland Engines with a Gnome H1000.

Vickers-Armstrongs (Aircraft) attracted considerable attention among visitors by the use of round-the-pole flying models of the Viscount and VC10, landing and taking-off under remote control. Rolls-Royce were exhibiting a Dart Mk. 510.

Westland, too, were exhibiting for the first time since their new association with Fairey Aviation, Bristol Helicopter Division and Saunders-Roe, Limited. Models, mainly of Westland and Saunders-Roe helicopters were shown, including the twin-Gnome Wessex and the Westminster with detachable pod containing a complete medical operating theatre.

Other British companies showing aeronautical products were Dunlop—illustrating the fact that they are providing the tyres and complete undercarriage equipment for the East German 152 four-jet transport; and Lockheed—who are producing the undercarriage equipment for the new Austrian light twin-engined aircraft, the Simmering-Graz-Panker M222. Air BP were also present in the Pavilion.—K.T.F.

Benevolent Fund Facts

LAST WEEK, Air Vice-Marshal Sir John Cordingley, Controller of the R.A.F. Benevolent Fund, gave some facts and figures in relation to its past year's efforts. No fewer than 14,986 awards were made in 1959, and £495,500 was spent on all forms of assistance to serving and ex-Service R.A.F. and W.R.A.F. personnel, their families and dependants.

At £66,923, the income from subscriptions and donations was some £11,000 less than in 1958, but this drop was more than counterbalanced by an increase of about £19,000 from legacies which, in 1959, stood at £138,358. From Service (non-public fund) sources the Benevolent Fund received £157,645 during the year.

Countries abroad from which calls for help from the Benevolent Fund were received, included Australia, Belgium, Burma, Canada, Cyprus, Denmark, France, Hungary, India, Israel, Malaya, New Zealand, Spain, Switzerland, the West Indies and the United States. The number of awards and the sums involved in various areas in 1959 were: England, 12,113 awards involving £406,704; Scotland, 1,082, £18,535; Wales, 629, £17,443; Northern Ireland, 201, £4,765; Republic of Ireland, 579, £5,626; and other overseas awards, 382, at a cost of £24,544.

Sir John has disclosed that since 1948, up to the end of 1959, the Fund has spent, on the relief of distress, £594,418 more than its income. There is, he says, a great need to maintain public support for the Fund—bearing in mind that its responsibilities to those who served in the late War are likely to increase in the 1980s "when they would be meeting the troubles that old age often brings."

A service of thanksgiving to mark the 40th anniversary of the founding of the R.A.F. Benevolent Fund will be held at the Church of St. Clement Danes tomorrow, April 2, at 10.30 hrs. The Duchess of Kent, President of the Fund, will attend the service, which will be conducted by the Chaplain-in-Chief of the R.A.F.

Tests for the Forty Four

CANADA'S first water tank for airframe fatigue tests is being built by Canadair at Montreal for the CL-44 turbo-prop transport. Static as well as fatigue tests will be made in this tank which will measure some 141 ft. by 23 ft.

A somewhat unusual feature of this tank is that at one end there is a side extension 33 ft. long to accommodate the aircraft's swinging tail when it is hinged to one side. With the tank emptied, various external loads are to be applied to the rear fuselage by means of hydraulic jacks and linkages and the swinging portion will be opened and shut under load.

For water tests, there is an adjoining reservoir 50 ft. in diameter and 30 ft. high with a capacity of 346,300 gallons. From this water will be drawn to fill the tank to a depth of 16 ft. The design of the tank and its reservoir has been done by Canadair's engineering laboratories and constructional work is being done by the Dominion Bridge Co. of Montreal at a cost of $140,000. The structural test programme on the CL-44 will be the responsibility of the Canadair structural test section and will continue through 1961.

A Helicopter Pioneer Dies

OSKÁR ASBÓTH, designer of the first Hungarian helicopter, died recently in Budapest at the age of 69. At an early age he became interested in gliders and is said to have built aircraft of this type before he was 20. Later he went to Austria and in 1911 designed an automatic stabilizing device which was successfully demonstrated in Vienna.

During the First World War, he designed the propellers for the Kármán-Petroszcy tethered helicopter. This had a pair of co-axial propellers initially driven by an electric motor and later by three 120-b.h.p. Le Rhône engines. This craft had no controls but had a three-cable mooring system for stability. It rose to a height of 150 ft. and remained airborne for an hour.

In 1928, Asbóth completed a helicopter of his own design; it, too, had two wooden fixed-pitch co-axial propellers. Control was obtained from six movable surfaces on horizontal hinges and hanging in the rotor downwash. With this machine, he achieved vertical flight in Sept., 1928.

The Asbóth helicopter created a good deal of interest in this country. Indeed, in Sept., 1930, Capt. R. N. Liptrot of the research and development section of the Air Ministry paid an official visit to Budapest and flew it.

Asbóth's machine was a noteworthy attempt to produce a helicopter with the simplest of rotating lift systems. It was not until the much later development of the ducted rotor, however, that the simple fixed-pitch "fan" could be made to work successfully for the production of direct lift of this sort.

MODIFIED ROTODYNE.—Now engaged in a further phase of its flight development programme, the prototype Rotodyne has had the addition of a third fin and fairings to the rotor-head and blade roots.

Desert Air Support

Photograph copyright "The Aeroplane and Astronautics"

ON returning from an inspection of the recent air mobility exercise "Starlight" in North Africa, Air Chief Marshal Sir Thomas Pike, Chief of the Air Staff, said that it had proved the ability of joint R.A.F.-Army co-operation to fly out and maintain a large number of troops in isolated spots. He also remarked there was no tactical air opposition to our forces during the exercise, nor is the overall capacity of Transport Command great enough. It will be a long time before the Service has a transport aircraft capable of carrying a tank, but there is a need for the Command to be able to carry heavier equipment.

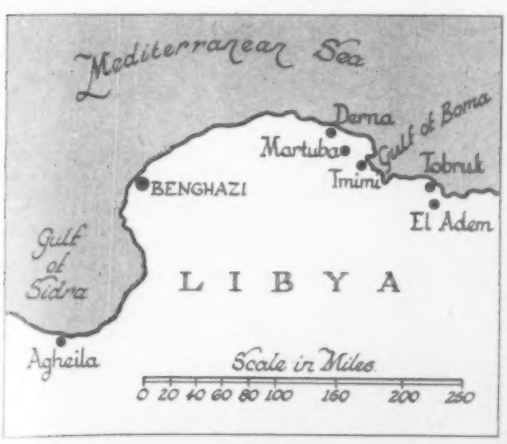
A five-day visit to the trials showed that "Starlight" incorporated a number of new techniques in addition to the methods of air transportation and supply practised during last year's United Kingdom mobility trials ("Red Banner" on Salisbury Plain in October and "Winged Coachman" in Northern Ireland during December). It combined both the long-range as well as the close-support tactical aspects of one of Transport Command's major rôles—the movement of the Army Strategic Reserve.

An ambitious exercise involving the airlift of the 1st Guards Brigade Group from the United Kingdom to Cyrenaica, "Starlight" was controlled on the air side by the recently re-formed No. 38 Group. It also included the employment of both carrier and land-based fighter/ground-attack aircraft, and the use of helicopters airlifted to the area of the operation.

Planned on a possible limited war condition of a friendly weak country being attacked by a stronger enemy equipped with some first-class equipment, such as armour, the exercise tested the use of the Guards Brigade Group on an assault basis. This meant that the force was limited to such units as Land Rovers, Ferret scout cars and 25-pounders, as every piece of equipment and stores had to be flown to the battle area from the United Kingdom. Without any transport aircraft capable of carrying a tank, the Brigade was deprived of such weapons which emphasized the great need for an anti-tank missile; a Malkara troop was, in fact, simulated for the exercise.

R.A.F. El Adem was employed as the overseas base airfield and a forward air head was established at Tmimi, near the main Libyan coast road some 53 miles to the west. A joint control and operations centre comprising the Headquarters of 3 Division and No. 38 Group's operational headquarters was set up at El Adem and a divisional maintenance area, an advance surgical centre together with a casualty evacuation unit, and an R.A.F./Army operations centre were established at Tmimi. Other units at the base airfield included an air transport movement control centre and a supply and aircraft loading organization.

The first phase started on March 10 with the strategic airlift of approximately 4,000 personnel and about 130 vehicles from the United Kingdom to El Adem. This was undertaken by



LARGE-SCALE LIFT.—The Bristol Britannia C.1s of No. 99 Squadron Transport Command made their first appearance in a large-scale operation in Exercise "Starlight." Their heavy lift capabilities over long ranges made an invaluable contribution to the strategic airlift.

Photograph copyright "The Aeroplane and Astronautics"

Whirlwinds of No. 225 Squadron picking up 1,000-lb. loads at the forward maintenance area at Tmimi.

five Britannias of No. 99 Squadron from Lyneham, 17 Hastings from Nos. 24, 36 and 114 Squadrons from Colerne, and the two Beverley squadrons—Nos. 47 and 53—from Abingdon with 10 aircraft.

Altogether, the Britannias made 35 sorties, the Hastings 45 and the Beverleys 26 during the strategic airlift which also included the earlier transportation of 12 Whirlwinds of No. 225 Squadron from Andover to Libya. The Britannias carried 110 fully equipped troops on each sortie and flew non-stop to El Adem, a distance of approximately 1,800 n. miles; the Hastings staged through Malta.

Operating simultaneously with the airlift, the second phase comprised the establishment of the air head at Tmimi and the tactical air move of the Brigade and R.A.F. ground personnel. Undertaken by the Transport Command Beverley force with the addition of two Beverleys from No. 30 Squadron at Aden and No. 84 Squadron from Kenya, this task added up to 205 sorties and was completed in 10 days. Altogether it involved the movement of some 3,500 men, 1¼ million tons of stores, 40 guns, 272 trailers and 370 Land Rovers and other prime movers.

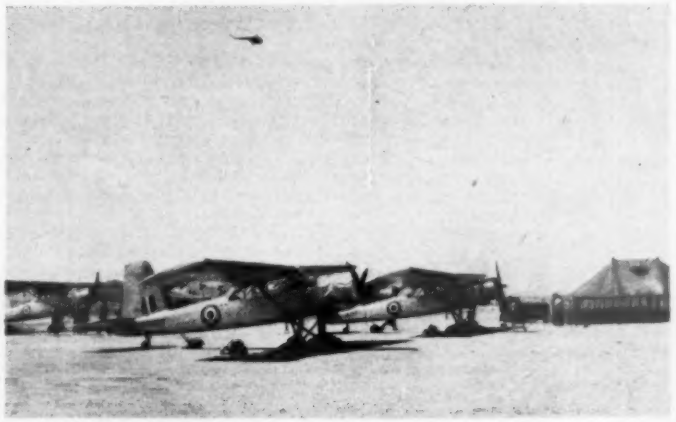
At the height of this forward move Beverleys were taking-off from El Adem every 15 minutes. The average time for the complete 106-mile round trip and unloading at Tmimi took approximately 1½ hours. The time spent on the ground at the forward air head obviously varied with the type of stores and equipment carried on a particular flight; vehicles were being unloaded in as little as eight minutes.

The third phase, with the logistic aim of maintaining by air support the Guards Brigade Group operating in the field, started on March 21 and lasted for six days. Consisting of both supply to, and casualty evacuation from, the battle area, this task was undertaken with the aid of parachute drops by the Beverleys operating from El Adem, and short-range close-support lifts by the helicopter force together with six Pioneers and two Twin Pioneers of No. 230 Squadron which had flown out to Tmimi from the U.K.

Based on the supplies needed to maintain the complete force for seven days plus a reserve period of three days, the air maintenance required between El Adem and Tmimi was estimated at 1,425 short tons, of which 728 tons were air lifted to the Brigade in the field and 375 tons went to build up the reserve. The remaining 322 tons comprised half Avtag for the helicopters and Pioneers and half local issues for the Army and R.A.F. personnel operating the air head.

In addition, the Beverley force was capable of air dropping 180 x 1-ton containers, 136 panniers and 24 x 3-ton supply platforms direct to the forward troops from El Adem.

Operating up to a maximum radius of 50 n. miles from the air head, the distance increasing each day as the Guards Brigade advanced towards their objective, the coastal town of Derna some 90 miles to the west, the helicopters carried



A view of No. 230 Squadron's dispersal at Tmimi. Flying Pioneers and Twin Pioneers, the Squadron operated with No. 225 Squadron Whirlwinds on the short-range tactical air lift of supplies to the Brigade Group in the field.

Troops of the Guards Brigade unloading a supply of petrol from a Twin Pioneer of No. 230 Squadron. It had been flown up from the advanced air head at Tmimi.

Photograph copyright "The Aeroplane and Astronautics"

1,000-lb. palletized loads. Brought up to Tmimi as 2,000-lb. pallets by the Beverleys, they were divided up so that the lower stores were complete for lifting by the helicopters and the top 1,000-lb. was ready for loose carrying by the Pioneers.

The latter moved the complete 1,000-lb. of freight in one sortie and the Twin Pioneers had an average payload of 2,400 lb. Starting at 2,250 lb. the load was slowly raised to 3,000 lb. as the Squadron became more experienced at operating under desert conditions. Above a range of 50 miles the payload of the Whirlwinds is not considered to be economical and the task of supplying the advancing troops falls more on the Pioneers supported by Beverley air drops.

From the tactical aspect of this type of ground battle, parachute supply dropping is not favoured as it is more liable to give away the Brigade's position compared with helicopter or STOL aircraft operations. For distances of under 50 miles, helicopters are generally favoured because they are less restricted to suitable landing strips.

The 1-ton containers dropped by the Beverleys were being used for the first time and the exercise provided an excellent opportunity of evaluating them. Developed from an American container but fitted with different release mechanism in the aircraft, they were carried by a single 42-ft.-diameter parachute. There are no air cushions under the container, which has shock-absorbing material in its base below the stores.

Employed in the rôle for which they are designed and seldom used—short-range (up to 200 miles) tactical freighting—the Beverleys more than proved their worth. Landing conditions on the loose sand and rock at Tmimi were far from ideal for such a heavy aircraft and reverse-pitch braking caused the Beverleys to be lost in their own sandstorm. This can be seen in the photograph on page 397.

The main landing area started off as a normally shaped 800 yd.-long strip, but by the end of the first day's airlift, it had to be moved 50 yd. to one side because of the deep ruts in the sand caused by landing and braking. Within a few days flying there were four such strips in use, with the taxi tracks over the earlier ones so that the Beverleys were acting as rollers compressing the ground for further use as a landing strip.

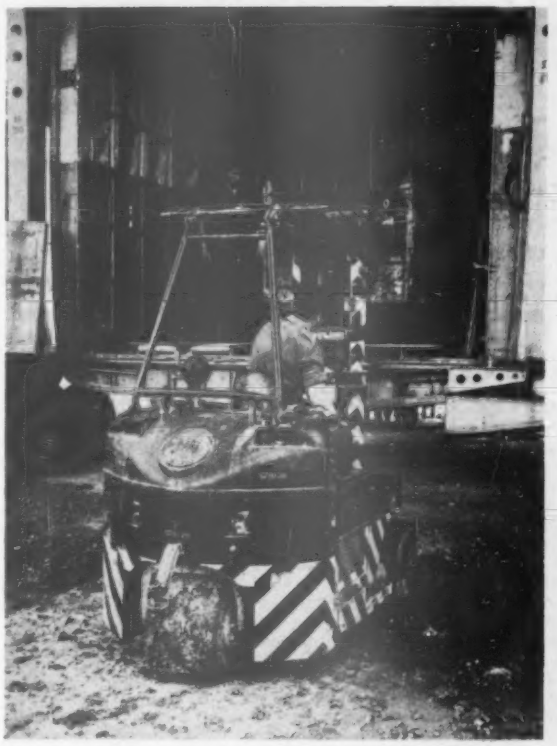
But, despite the sand and its effects on wheels, brakes and engines, the serviceability rate of all the aircraft operating from or into Tmimi was high. At the start of the tactical air move from El Adem the disc-brake units on the Beverleys were getting blocked by sand, but after the removal of the main undercarriage oleo fairings they were blown clean after every take-off by the air flow.

Both at El Adem and Tmimi fork-lift trucks and other industrial vehicles were employed to load and unload the Beverleys. They were also used at the air head to transfer supplies to the forward maintenance area (F.M.A.) where the pallets were prepared and broken down for air lifting by VTOL and STOL aircraft. These Pioneers and Whirlwinds started flying at 06.00 hrs. each morning and were available up to 23.59 hrs.—leaving six hours in every 24 for maintenance.

Apart from being the first major undertaking by No. 38 Group, the new Transport Command specialist tactical air support formation established in January, 1960, the exercise is the last for this financial year. It is by no means the end of the combined Services trials programme and there is plenty of room for the introduction of a number of additional factors in future exercises.

These could include the case of the enemy possessing an air strike capability, as opposed to our own complete air superiority simulated in all the exercises to date. Obviously this would introduce the problem of air defence for the air head and make the tactical support tasks of the Beverleys, Pioneers and Whirlwinds very hazardous.

Limited ground attack on the air head was introduced in "Starlight" and one Beverley and two helicopters were "knocked out" of the battle. But the complete air/land defence of this vital area will have to be tested if a more realistic approach is to be given to such an operation.—P.R.R.



A fork-lift truck lifting stores into a Beverley at El Adem. Industrial vehicles were also employed to unload aircraft and distribute supplies at the air head.

A Beverley of No. 47 Squadron taxi-ing out from its dispersal at R.A.F. El Adem. During the ten-day build-up at the start of the exercise, the Beverley force moved some 3,500 men and their equipment forward to Tmimi.

Photographs copyright "The Aeroplane and Astronautics"

Air Transport

Reprieve for Propellers?

AFTERTHOUGHTS based on the still-limited comparative information about the old and new IATA fare structures suggest that the effect of the changes may go a long way towards helping those operators who have modern propeller-driven equipment—as well as helping privately financed passengers.

The revised fare and accommodation arrangements, complicated though they may be, also offer the prospect of attracting air travellers of the earlier school who enjoyed the relatively spacious and less-hurried journeys of the Stratocruiser era. The days of sleeping berths and cosy gossips in a downstairs bar have gone for ever, but the sleeper-seat and good service may encourage limited preference for propeller aeroplanes.

In short, although it is unlikely that operators will be taking out and dusting down some of the older equipment which is awaiting buyers, there may be a new lease of working life for the Britannias and even for some of the later piston-engined aircraft. It may even be that, at the next IATA traffic conferences, some carriers will press successfully for further relaxation of the accommodation rulings. Meanwhile, the North Atlantic operators who have Britannias—B.O.A.C., Canadian Pacific and El Al—should be able to keep them filled for a year or two longer than they were beginning to think possible.

Put down briefly on paper (see last week's issue, p. 361) the agreed fare differentials may not seem to be remarkably attractive in relation to the total cost involved—but to the person paying for transport and a holiday (particularly where a family is involved) the little sums mount up.

The revised North Atlantic return fares (New York-London) are: First-class turbojet, or sleeper-seat propeller aircraft, £321 10s.; standard first-class, propeller aircraft, £282 18s.; economy-class turbojet, £173 12s.; economy-class, propeller aircraft, £160 14s., reducing to £154 6s. during the winter months; 17-day economy excursion (October 1-March 31), turbojet aircraft, £125 and propeller aircraft, £114 6s.

Examples of rates for some other routes, as given by B.O.A.C., show that the trend from October 1 will be for increased first-class fares and reduced tourist (or "economy") fares. These are (one-way, present fares given in brackets): London-Rangoon, first-class, £295 (£278), economy, £179 (£196); London-Tokyo, first-class, £402 (£379), economy, £242 (£257); London-Sydney, first-class, £390 (£371), economy, £248 (£264); London-Accra, £166 (£158), economy, £98 (£104).

Eurocontrol Visit

THE Technical Working Group of Eurocontrol has just concluded a week's conference in London—the 12th of a series. On March 24 the delegates visited the Ministry of Aviation's Air Traffic Control Experimental Unit at London Airport after spending the morning in discussion of a series of papers presented by radio and radar manufacturers.

Among the papers was one from Ferranti describing the experimental computing and data-processing system developed for use at Prestwick's Oceanic Area Traffic Control Centre. Other papers dealt with control-centre data-processing (Standard Telephones), data links (G.E.C.), secondary radar (Cossor), airborne navigation aids (Decca Navigator), A.T.C. display systems (Decca Radar) and radar remoting techniques (Marconi). The delegates will also have discussed the Ministry's programme for the experimental semi-automatic A.T.C. system on which various companies have been working.

The Eurocontrol Technical Working Group, 40 delegates from which were invited by the Ministry, is responsible for working out a plan for a common upper-airspace A.T.C. system over Western Europe, to be operated, eventually, it is hoped, by an international agency. Later this spring there is to be a meeting of the directors-general of civil aviation, or other appropriate national representatives, to consider a draft convention designed to put the plan into effect. Eurocontrol representatives in the working group come from the six Common Market countries and the United Kingdom.

A Million Proteus Hours

IN the three years since the Bristol Britannia went into service (in February 1957 with B.O.A.C.), a quarter of a million revenue flying hours have been logged, so the total of Proteus engine hours now exceeds one million. The Proteus has been, for the whole of this period, the most powerful turboprop in airline service outside Russia. It was the first axial-flow turbine and the first free-turbine engine in commercial aircraft.

Proteus-engined Britannias are in service to-day with six major airlines, three charter operators and R.A.F. Transport Command. The first version of the engine was the 3,900 e.h.p. Proteus 705 in the Britannia 102 (B.O.A.C.) which achieved an overhaul life of 2,000 hr. within 22 months of going into service. Clearance for 2,400 hr. between overhaul is likely to be given soon.

Later versions of the Proteus have been developed and put into service, giving take-off powers up to 4,445 e.h.p. and having an s.f.c. of 0.486 lb./e.h.p./hr. in the cruise at 325 knots at 25,000 ft.

The VC10 Family Grows

A WHOLE family of designs based upon the VC10 is now being studied in the Vickers project office and the first version of the design, in production for B.O.A.C., may prove to be commercially the least important. This was the view of Mr. E. E. Marshall, asst. chief engineer (aircraft) of Vickers-Armstrongs (Aircraft), when he addressed the Weybridge branch of the R.Ae.S. last week. In addition to describing the VC10 itself, Mr. Marshall related its history as a project and described some of the future variants now being projected.

One of these is the Super VC10 (see THE AEROPLANE AND ASTRONAUTICS for Feb. 12, 1960), which is the VC10 "optimized" for the North Atlantic. The proposed stretch includes an extra 20-ft. fuselage section forward of the wing and an extra 8 ft. behind the wing, to provide nine more seat rows. This increases maximum passenger capacity from 150 to 204, and the weight goes up to about 350,000-360,000 lb.

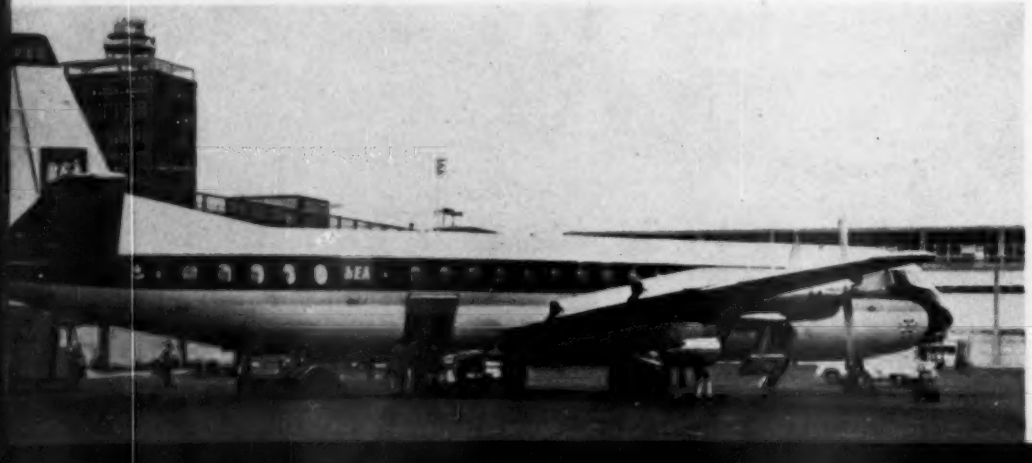
Additional fuel can be carried by the Super VC10 in wing-tip tanks of about 600 gallons capacity each. In answer to a question, Mr. Marshall said that all possible locations for extra fuel had been studied. One possibility was to put 10,000 lb. (1,250 gal.) in the fin, but this produced a pitch problem as the fuel was used.

Very long ranges can be offered in developed VC10s—sufficient, for instance, for London-Vancouver or London-San Francisco flights non-stop. Such a long-range version is proposed for Transport Command as a Comet replacement to carry troops, casualties or freight. It would have flight-refuelling provision and could also serve as a flight-refuelling tanker. A non-stop operation to Australia would be possible with two en route refuellings, the tankers flying from British and Australian bases respectively.

As a civil freighter the VC10 could carry payloads of 80,000 lb. non-stop between Paris and New York, and costs could be brought down to between 4d. and 5d. per ton-mile.

Mr. Marshall recalled that, following the "bitter blow" of the V.1000 cancellation in 1955, Vickers had resumed work on

(*Continued on page 401*)



NEW WORLD VISIT.—The Vickers Vanguard made its first appearance in the U.S.A. on March 21 when it called at Idlewild while en route to Trinidad where it has been demonstrated over B.W.I.A. routes. Noise measurements were made while the Vanguard, which has now returned to the U.K., was in New York.

Only the VANGUARD has this future while making money right from the start

THE VICKERS VANGUARD is designed for growing traffic, yet it will make profits right from its introduction with payloads no bigger than those carried by Viscounts today.

This is clearly shown in the illustration. Profit begins with the first 500-mile trip carrying no more than 42 passengers and 640 lb of freight. Even on modest estimates of traffic and freight increases, its profits will grow considerably with the years.

Assuming a 10% increase per annum in traffic, and 7% in freight, annual and cumulative profit at the end of seven years is remarkably high. By employing the Vanguard's cheap-fare possibilities, payloads and profits could be much higher.

YEAR	PASSENGERS	FREIGHT	MAIL	TRIP PROFIT
[illegible]	42	640 lb.	250 lb.	$129
[illegible]	50	735 lb.	250 lb.	$490
[illegible]	61	840 lb.	250 lb.	$930
1964	74	960 lb.	250 lb.	$1,450
1966	90	1,100 lb.	250 lb.	$2,100
1968	103	1,260 lb.	250 lb.	$2,870

This diagram shows trip profit on a 500-mile sector at realistic European costs and current tourist fares. The start-point is 42 passengers and 640 lb of freight in 1958.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

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Air Transport . . . .

(*Continued from page 400*)

a jet transport in May, 1956, with a low-operating-cost Viscount replacement in mind. The earliest ideas used a Viscount body with a Vanguard wing and four Nenes in paired nacelles on the wing. The weight was about 110,000 lb. and a 15,000-lb. payload could be carried over 1,300 miles. The idea of putting the engines at the rear first occurred about this time. Vickers had already, in 1952, designed the SB2 expendable bomber with a Rolls-Royce Soar at the tip of each tailplane and the fin; and even earlier had put a Whittle jet unit in the tail of a Wellington for test purposes.

Among the steps to the VC10, illustrated by Mr. Marshall, all based on the Vanguard fuselage, were a project with Valiant outer wing panels and rear-mounted Avons; another with Scimitar-type wings and three rear-mounted Avons; a swept-wing design with four podded Bristol BE47s, for comparative study; and the Vanjet offered to B.E.A. and T.C.A. with three rear-mounted Conways. (The evolution of the VC10 was traced in detail in our issue of November 20, 1959.)

The B.O.A.C. specification which actually resulted in the VC10 was issued in the spring of 1957 and called for an aeroplane able to operate on the Eastern Hemisphere routes with a direct seat-mile cost of 1.2d. A study of the routes involved showed that the Singapore-Karachi stage was the most critical, and this initially controlled the size of the wing. Later, the idea of using a Vanguard-size fuselage was abandoned in favour of a larger diameter to permit B.O.A.C. to standardize the cabin with that of the Boeing 707. Weight increases kept pace with engine development, leading eventually to Atlantic capability being offered. By the time the B.O.A.C. contract was signed, on Jan. 15, 1958, the VC10 had become economically acceptable for all B.O.A.C. routes; although not necessarily the optimum aeroplane for every route, it gives the best average fleet economics over the whole route network.

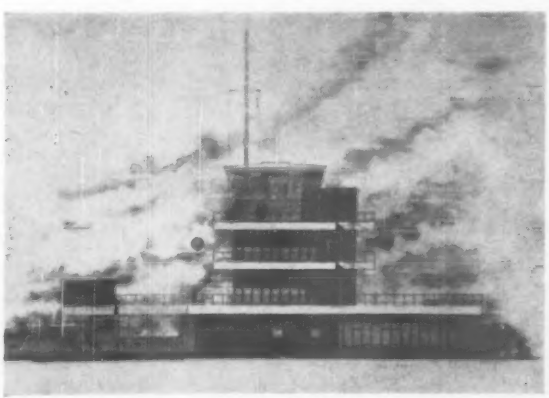
Work started on detail design in the drawing office in March, 1958, and a 44-month programme has been laid down for design and manufacture up to the first flight. This period is exactly the same as that achieved with the Vanguard; a measure of the effort involved can be gained by remembering that the fuel alone in the VC10 weighs as much as a fully loaded Vanguard, and that the weight of the fully loaded VC10 will be higher than that projected for the developed Brabazon.

Electra Limited

A SPEED limitation has been imposed on the Lockheed Electra by the F.A.A., following the disintegration of a Northwest Airlines Electra near Tell City, Indiana, on March 17. Notifying Lockheed Aircraft Corp. of this precautionary safety measure, the F.A.A. said: "The Tell City crash now appears to be sufficiently similar to a previous accident of the same type of aircraft last September near Buffalo, Texas, to justify operating restrictions pending further investigation."

The limitation imposed by the F.A.A. restricts the level flight speed below 15,000 ft. to 275 knots I.A.S. (347 knots true at that altitude). Above 15,000 ft. the I.A.S. restriction is linear to keep the T.A.S. below the 347-knot value. The Electra type specification gives the limit level flight speeds as 324 knots E.A.S. below 12,000 ft. and Mach .615 above 12,000 ft. Thus, at 15,000 ft., the normal Electra limitation is 385 knots true and the reduction imposed by the F.A.A. is 38 knots. At 20,000 ft. the normal limit is 378 knots true and the F.A.A. restriction is 31 knots. K.L.M. reported on March 21 that it was imposing a 260-knot I.A.S. limitation on its Electras pending the result of the investigation.

The previous accident referred to by the F.A.A. was that to a Braniff Electra. At the C.A.B. public hearing into this accident last month, it was reported that the port wing had failed upwards, followed immediately by fire and secondary structural failure. In the Northwest accident on March 17 one wing is reported to have been found several miles away from the main wreckage.



Work has now started at Prestwick on this new 58-ft. high control tower, to be situated south-east of the present tower. The top floor has a split level, with a control room for approach and aerodrome operation and a radar room for surveillance of the local area and final approach paths. The main Prestwick runway, extended to 9,800 ft., should be reopened in June.

The Air-freight Business

THE need for maintaining short turn-round times and for finding means of making the most of the volume available in the unnatural loading shapes of high-speed turbojet transports has produced various pre-loaded-container projects.

United Air Lines uses tub-shaped, glass-fibre baggage containers to match the DC-8s cargo-compartment contours. Eleven containers can be fitted into the holds whilst leaving enough space for more bulky cargo shipments. The containers are lifted in and out by integral electric hoist and are positioned in the hold like beads on a string.

Now Pan American is about to introduce (initially on the Miami-San Juan run) a cargo capsule system developed by a Lockheed Special Products team in Atlanta from a concept originated by P.A.A.'s Latin American Division. Seven of these contoured pre-loaded "PAAks" (as they are called) can be carried in a 707-321 and they are loaded by conventional fork-lift handling equipment through side doors. A roller-bearing track enables the capsules to be moved forward or aft into position, where they are locked in place.

One of the Lockheed-P.A.A. cargo capsules being loaded.

The cost in additional weight is high by normal standards (1,450 lb., including the installation in the aircraft) but not in relation to the 707's total capacity payload and is justified by the saving in loading time. Each PAAk has a 1,500-lb. capacity and about 4½ tons of pre-loaded cargo can be loaded or unloaded in less than 10 minutes. The capsules will be made available to other 707 operators, to cargo shippers and to manufacturers who will be able to pack and seal them at the factory.

In response to U.S.A.F. Air Materiel Command's request for bids from commercial operators for one-year-contract transcontinental services, National Airlines has offered to buy a minimum of five Lockheed C-130Bs. The offer is, however, subject to a commitment from the U.S. Government to offer a five-year contract when the first contract expires on June 30, 1961. The British independents are not the only operators who find it difficult to plan a re-equipment programme on short-term operating contracts.

In this new picture of the Sud-Aviation production shop at Toulouse, Caravelles for four airlines can be seen. In the foreground is one for Swissair (deliveries begin this month), with two Caravelle IIIs for Alitalia following it down the line. On the farther production line are aircraft for S.A.S. and Air France.

Riddle and the Future

FOLLOWING the second major reorganization in two years, Riddle Airlines is setting out to more than double its revenue from all-freight operations in 1960, in a final effort to become established on a profitable basis. A progress report made to more than 8,000 stockholders by the new president of Riddle, Mr. Robert M. Hewitt, deals frankly with the difficulties the airline has encountered and indicates some of the steps being taken to overcome them.

Of the $9 million invested in Riddle, Mr. Hewitt notes, more than $7 million has been lost. Although the net losses in the last quarter of 1959 were substantially lower than a year before, revenues also were reduced and the key to future success is seen to lie in a major campaign to sell air freight rather than in effecting internal economies—although this also has been done. The target is to sell $5 million worth of commercial air freight in the first six months of 1960 and a total of $12 million in the year, compared with $5¼ million worth of freight carried in 1959.

Since the middle of March, a new commercial charter service has been offered by Riddle, to obtain utilization from some of its inactive C-46s. On April 25, new scheduled cargo operations will begin with a fleet of two DC-6As, three DC-4s and four C-46s; the addition of DC-6As to the fleet will reduce the operating cost of this scheduled operation by $87,000 a month. The company is also hoping to obtain from the C.A.B., in the Domestic Cargo-Mail Services Case, a permanent certificate, eligibility for subsidy and permission to operate to the West Coast; and also hopes to renew its Logair contracts with MATS in July. Riddle held Logair contracts from July, 1955 to June 1959, and the loss of this work was a severe blow to the economy of the airline.

The possibility that Riddle will buy new aircraft is mentioned by Mr. Hewitt, but no specific reference is made to the Armstrong Whitworth Argosy, for which Riddle at one time had placed a provisional order.

A detailed analysis has been made by Riddle of the basic operating economics of the all-cargo carriers compared with the passenger carriers with which they must compete. Among the results of the survey were the following facts:

1. That all-cargo carriers receive 95% of their revenue in scheduled service from air freight for which they receive less than 20c/ton mile. Passenger carriers receive in excess of 91% of their revenue from passenger traffic at more than 58c/ton mile.
2. The all-cargo carriers have load factors of 70%; U.S. domestic trunk carriers have load factors of 53%.
3. The all-cargo carriers' operating expense per available ton mile is 20.4c, compared to the domestic trunk carriers' figure of 27.3c.

Compared with this average ton-mile cost of 20.4c for freight carriers, Riddle succeeded, in October, 1959, in reducing their cost to 16.4c ton-mile. In the same month, 2¼ million revenue ton miles of traffic was carried at an 80% load factor at 21c/ton mile, to produce a profit of 0.537c/available ton mile, or a profit for the month of $17,438.

U.K. Traffic Growth

STATISTICS issued by the M.o.A. show that air transport movements at U.K. airports in 1959 were 6% over the 1958 total, and the number of passengers handled increased by 17%. Freight traffic was up by 35%.

The table below summarizes the statistics. Included in the list of individual airports are all those in the London area (L.A.P., Blackbushe, Croydon, Gatwick, Stansted and the Westland Heliport) and other U.K. airports where air transport movements exceeded 10,000 during the year. In its first complete calendar year of operation, Gatwick took its place as the second busiest London airport in terms of transport movements and passengers handled. In the London area as a whole, movements increased by 3% and passengers by 18%; because of the growing use of Gatwick, London Airport recorded only a 1% increase in movements and a 15% increase in passengers.

First monthly statistics for 1960 show that in January, air transport movements were 21% higher than in January, 1959; passenger traffic increased by 33% and freight by 66%. The 1959 figures were unnaturally depressed by the large incidence of fog.

BRITISH AIRPORT ACTIVITY, 1959

	Aircraft Movements		Passengers Handled			Freight set down and picked up	Mail set down and picked up
	Total	Air Transport	Total	Terminal	Transit	Short Tons	
Total U.K. airports (1959)	727,181	358,388	8,309,420	7,866,588	442,832	248,898.9	19,873.2
Total U.K. airports (1958)	719,122	339,853	7,106,411	6,761,171	345,240	184,609.6	18,755.0
London area airports (1959)	210,986	142,969	4,692,840	4,600,823	92,017	78,893.1	13,291.5
London area airports (1958)	258,318	139,136	3,993,438	3,953,161	40,277	63,318.5	12,340.3
Selected U.K. airports (1959)							
London	129,641	118,809	4,097,058	4,012,187	84,871	69,761.6	12,912.7
Ferryfield	33,650	32,731	261,195	261,195	—	101,319.5	—
Manchester (Ringway)	32,735	25,908	565,840	489,078	76,762	9,492.9	2,785.5
Southend (Rochford)	62,553	23,222	216,658	216,658	—	29,947.0	—
Glasgow (Renfrew)	22,858	20,161	528,482	505,025	21,657	3,123.3	335.1
Gatwick	22,165	15,617	323,755	320,840	2,915	4,506.5	1,752.8
Belfast (Nutts Corner)	13,881	12,755	369,697	367,850	1,847	8,313.7	372.6
Isle of Man (Ronaldsway)	12,697	10,884	218,104	204,125	13,979	1,400.3	168.7
Blackbushe	22,170	5,085	192,823	187,949	4,874	569.4	6.2
Croydon	12,264	2,942	15,519	15,499	20	8.8	—
Stansted	23,968	346	17,353	16,948	405	237.7	—
Westland Heliport, London	778	170	390	390	—	1.9	—

West Germany's Plans for Military Aviation

GERMANY'S plans for her future in the air must not be underestimated. It is increasingly clear that the German industry is pressing on towards a goal of self-sufficiency which though still some way off may now be said to be in sight.

A speech of considerable importance in this connection was that made by Ministerialdirigent Dr. Theodor Benecke at Bad Godesberg in Germany last month. He was speaking on the subject of American-German cooperation in the realm of aircraft and missiles (not yet spacecraft).

We do not have the text of his full speech but are grateful for an English translation prepared by the Lockheed Aircraft Corporation. From this the extracts that follow are published in full:

Introductory Remarks

As far back as in 1955—the year Germany became a member of NATO—U.S. deliveries of aircraft to the Luftwaffe began according to the Nash-List. These deliveries, a type of lend lease gift, included 450 Republic F-84F fighter-bombers and 108 Republic RF-84F reconnaissance planes. In addition, Canada contributed 75 Canadair Sabre 5s as a gift, while an additional 225 Sabre 6s for use as day fighters were purchased. Moreover, we bought another 88 North American F-86K all-weather fighters, built under license at the Italian Fiat plants. These planes, together with English navy planes, (Hawker Sea Hawks), the French transport Noratlas, and training planes such as Piper, T 6, T 33, Fouga Magister, and Piaggio, as well as some helicopters, make up the equipment used by the German Air Force.

The U.S. Air Force not only put their planes at the disposal of the German Air Force, but as of spring 1956 also undertook the flight training programs. Training of pilots, at first under American leadership, later on with American assistance, began in Fürstenfeldbruck and Landsberg and has been going on there ever since.

A coordinated training program for technical personnel, with American instructors in charge, started in Kaufbeuren in the spring of 1956. Earlier in 1955, the first three World War II veteran pilots, Messrs. Steinhoff, Kuhlmay and Hrabak, were sent to the United States for a complete pilot training program.

USAF advisory teams and technical representatives of US firms have been assigned to most German Air Force units. Parallel to these efforts, USAF and American firms such as Vertol, Sikorsky and Curtiss Wright offered a series of technical courses.

In the field of guided missiles cooperation understandably did not start until later, but, here again, this program has now reached considerable proportions. Nike-System training first started in the fall of 1957 at Fort Bliss near El Paso, Texas. Courses are currently scheduled for staff, maintenance and repair personnel, at both Fort Bliss and Redstone Arsenal.

The Mutual Security Military Sales Agreement, signed by the United States and the Federal Republic in 1956, serves as the contractual basis for all past, pending, and future orders placed in the United States. The Off-Shore Agreement on American production orders executed in Germany, signed in 1954, represents an additional basis for cooperation. This agreement deals primarily with tax and customs provisions.

Another important contract, the Weapons Production Program, is about to be ready for final signature. It will lay down rules and regulations for joint production of arms, developed in the United States such as the Hawk and Sidewinder Systems and will cover all such license production as will be undertaken on the basis of governmental agreements. In addition there are licensing agreements. The extensive German-Dutch-Belgian F-104 program rests on such an arrangement.

The German-American agreement of 1956 on the Mutual Weapons Development Program is also to be mentioned. This treaty provides for cooperation between the two nations in research and development and has turned out to be extraordinarily successful.

By themselves, however, all these agreements do not suffice to assure real practical cooperation and a positive exchange of ideas and experience. The United States went a step further by maintaining well-staffed institutions in Germany and Europe. At the American Embassy, in Bonn, in addition to the air attaché Col. Miller, Prof. Dr. Audrieth is acting as attaché for scientific affairs. There is also the Military Assistance Advisory Group (MAAG) headed by General Thatcher and his deputy, General Steinbach. Moreover, there is the European Office of the Air Research and Development Command.

Equipping the German Armed Forces with manned planes and guided missiles may be regarded as a three-stage development:—

The first stage, that has now been concluded, involved rearmament with Allied equipment such as listed earlier in detail.

In **the second stage** we are at the present time continuing to take over armament systems from our NATO-allies by adapting them to tactical and technical requirements formulated by German staff commands in due consideration of the specific geographical and political situation of the Federal German Republic.

During **the third stage** we shall attempt to provide our own German contribution.

The cooperation between Germany and the United States represents an important basis for all three phases of the build-up.

Let me cite the F-104 program as an example for the second stage. The decision in favor of the F-104 as the plane for the German Air Force was preceded by a detailed two-year evaluation on the part of the Air Force Staff Command (Führungsstab Luftwaffe) and the Armament Evaluation Department (Abteilung Wehrtechnik) of the Federal Ministry of Defense. Every type of plane available in NATO-countries and Sweden, suitable for German Air Force assignments, was examined.

Fifteen months ago the decision was taken in favor of the F-104 since, technically, this plane was the most advanced type and because, from a tactical viewpoint, it met all of the German Government's requirements. The German version of the F-104, the F-104G, which with minor modifications has been adopted by the Canadian, Dutch and Belgian air forces—*a satisfying confirmation of the German decision*—is a combined interceptor fighter, fighter bomber, reconnaissance and marine reconnaissance plane. Thus, the German F-104G is no more an interceptor only, as is the case with the original American F-104A and F-104C, but a multi-purpose plane for both defensive and offensive air defense.

An important reason tipping the scale in favor of the F-104 was the fact that at the time of the German decision this plane had been produced at Lockheed's Burbank Division and had been serving with the US Air Force Tactical and Air Defense Command. To meet the German requirements it was necessary to reinforce the control surfaces as was done with the F-104D, the American training plane version of the F-104. This also meant reinforcing the connections between the fuselage and wing structure. Engine and accessories remained unchanged.

Difference in equipment between the F-104G and the F-104A and C respectively is due, as mentioned before, to necessary diversified assignment requirements and involves essentially: the entire navigational equipment, in particular inertia navigation and the automatic pilot; fire control systems; target aiming instruments; air data computor and the ejection seat.

British Ejection-seat

For safety and standardization reasons the German Government insisted from the outset on the upward Martin Baker ejection seat. USAF's F-104Cs and F-104Ds will be equipped with an American-type upward ejection seat.

As with American units, air-to-air guided Sidewinder missiles will figure as one of the most important weapons of the German F-104G.

German F-104 license production heralding large-scale German-American cooperation in this area, is a three-part program. Thirty training and 66 fighter planes will be built at Lockheed plants. The South German airplane factories' group will be responsible for the teamwork-production of another 210 fighting planes. Production of a further 364 planes, allocated by the Bundestag Committees as part of the second supplementary Air Force budget, will be undertaken by North German airplane factories including Hamburger Flugzeugbau GmbH, Weser-Flugzeubau GmbH and Focke-Wulf in joint production with Dutch and Belgian firms; geared to Dutch and Belgian production programs.

Present plans provide for engine production at BMW Triebwerkbau GmbH, Allach, Germany, and at the Belgian National F N works. Present plans likewise envisage large-scale license production of American equipment and instruments in Germany, Belgium and the Netherlands, NATO's Western European rearmament efforts have been hampered up to now by differing production targets and schedules. As demonstrated by the F-104G program, mutual goodwill may well lead to a combined effort based on common interest between Western European NATO nations with profitable economic and political results for all.

This program has resulted in thorough cooperation between American development and production firms and their

European licensees, giving German industry a chance to profit widely from American specialized know-how.

While it is true that actual production of the fuselage, despite its top-grade aerodynamical design and maximum thermal resistance, does not involve any new revolutionary methods, development from the first blueprints to present designs is nevertheless of utmost importance for the German aviation industry. As to engines this effect is even more decisive. Because German production of jet power plants for airplanes was halted in 1945, license production of the most advanced J79 General Electric power plant gives us a chance to keep up with technical development in this field.

As a result of the F-104 program the highly developed technical knowledge of American aviation, electronics, equipment and engine industries will reflect on corresponding German industries. Moreover, German personnel both in industry and the military forces will become familiar with modern American airplane testing methods in the course of a mutual F-104 testing program, scheduled at Lockheed's Palmdale and USAF's Edwards testing sites.

At first individual parts will be tested at the plant with final evaluation flights by German, Canadian and American pilots, with USAF acting in an advisory function only, as the final approval will rest with the German and Canadian pilots. Hereupon the entire weapons system will be tested in evaluation flights at Edwards. Here again final decision will be with the Germans (USAF representatives serving as advisers only). Final testing in simulated army-air force combat assignments, preferably in Germany, is slated for the third stage.

Sidewinder Program

Another aspect of German-American cooperation involves the before-mentioned air-to-air Sidewinder guided missile program, as part of the second stage of the Bundeswehr armament. As is well known the Sidewinder is a rocket-propelled air-to-air missile, equipped with an aiming device reacting on thermal rays, thus guiding the missile to the target. Sidewinder license production will be promoted jointly by Norway, Denmark, the Netherlands, Greece, Turkey and Germany. The bulk of the European orders will be placed with a specially founded subsidiary of Bodenseewerk Perkin-Elmer GmbH at Uberlingen.

In the future, following the F-104 and the other armament programs mentioned in the speech, Germany intends to make her own technical contribution. This requires thorough cooperation in research and development. Within the framework of the Mutual Security Program, passed by Congress, the before-mentioned Mutual Weapons Development Program became effective in 1956. The Mutual Weapons Development Team, established for this program in Paris, holds semi-annual meetings to discuss progress made in individual projects. These projects cover airplanes and guided missiles, problems of vertical take-off, power plants, electronic air defense, fire control systems and other airplane equipment, and problems of intercepting very low-flying aircraft.

A modest German contribution to the American space program heralds another chapter of German-American cooperation. NASA (National Aeronautics and Space Administration) charged with this space program, has invited European NATO countries to participate. It is quite possible that we shall provide some of the payload.

Jetliners and Gas Turbines in East Germany

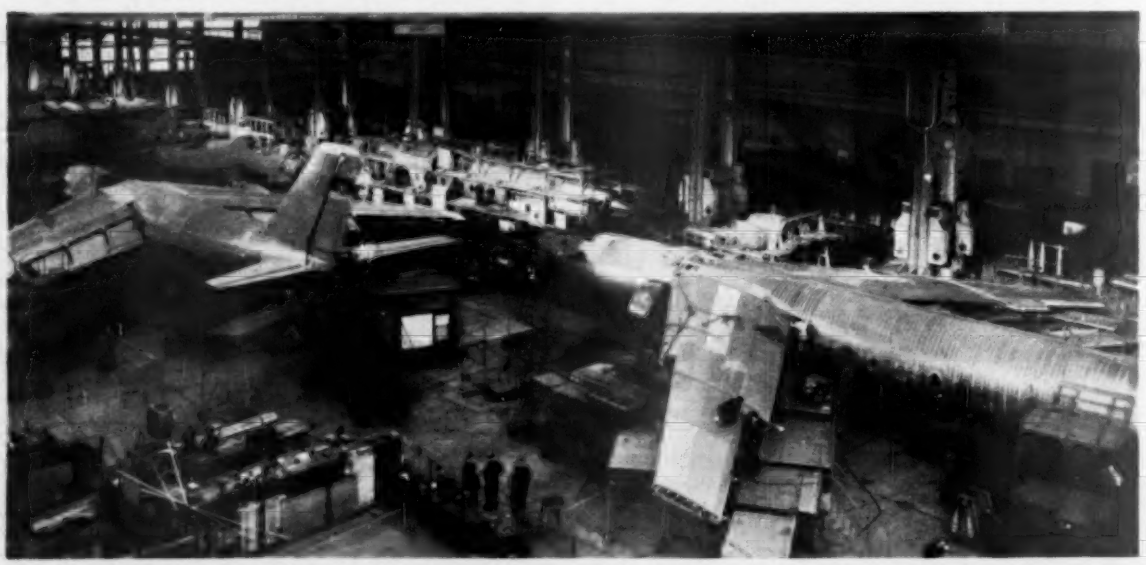
ONCE again the Pavilion of Volkseigene Flugzeugindustrie, Dresden, the State-owned aircraft industry of the German Democratic Republic, was a centre of great interest at last month's Leipzig Spring Fair. Once again, too, the most striking exhibit was the turbojet airliner 152, with its Pirna 014 axial gas turbine. The first prototype of this aircraft, which was lost in a crash on March 5 last year, was, it now transpires, the one and only—reports stated, at the time of the accident, that there was another which would continue trials without interruption.

As the court of inquiry had decided that the crash had been due to an error of judgment on the part of the test pilot and not to any structural weakness or fault in design of the aircraft, work was started soon afterwards on the construction of a new machine. This has a slightly longer fuselage but is otherwise essentially the same as that which crashed.

This time, however, four prototypes are being built, all of which are expected to be completed and in service this year. The aircraft is expected to be in production, and available for export, in the second half of 1961.

Perhaps the most interesting new exhibit at Leipzig this year was a small 130 h.p. gas turbine, produced by VEB Entwicklungsbau, Pirna (described in THE AEROPLANE for April 10, 1959), after a long period of development and trial since the end of 1955. Known as the Pirna 017, this gas turbine has three variants which can be used for a variety of purposes, both on the ground (e.g. for electric power generation, for fire and drainage pumps and for propelling vehicles) and in the air for helicopters and aircraft. The advantages claimed for them are that they are light, small, and easy to start in all weather conditions. The manufacturers are ready to go into series production with them as soon as orders are forthcoming. These engines have a single-stage centrifugal compressor driven by a two-stage turbine; turboshaft and turbojet versions are available.

Of the three variants the 017A is, in effect, a trial model intended primarily for test purposes; its series production is not contemplated. It has proved completely satisfactory, however, during tests of 1,000 hours. It weighs 120 kg. The 017D is intended for vehicles; it has two heat-exchangers to provide for more efficient use of fuel. Developed from the 017D, the 017E is intended for industrial use and has no heat-exchanger; it is therefore less bulky and lighter and weighs 100 k.g.—E.P.Y.



JETLINER PROTOTYPES.—Four 152 transports powered by Pirna 014 turbines are being built in Dresden.

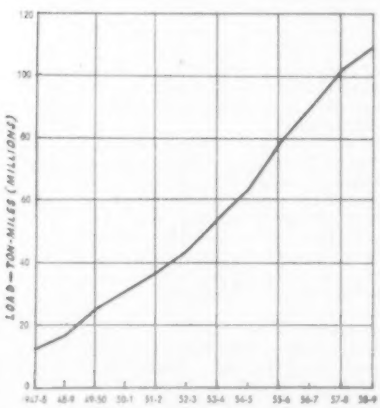
From Viking to Comet 4B

Photographs copyright "The Aeroplane and Astronautics"

The scene at Northolt during the naming ceremony before the first Viking service—to Copenhagen on Sept. 1, 1946. At the foot of the page is the Comet 4B, and B.E.A.'s load ton-mile progress is shown in the graph.

DURING the 14 years of British European Airways' history—which began operations in February, 1946, though the Corporation was not legally established until August of that year—the emphasis has been on the development of services and traffic using British aircraft. With two exceptions, the aircraft of B.E.A.'s fixed-wing fleet have come exclusively from this country's own industry, whose only full commercial aircraft sales success, that with the Viscount, stemmed initially from the Corporation's interest and eventual practical encouragement.

The two exceptions have been the inevitable and ubiquitous DC-3s—with which services were started and which are still producing something like 10% of the Corporation's total ton-miles—and the long-forgotten and briefly operated Junkers Ju 52s, or Jupiters as they were named by B.E.A.



It would be foolish to pretend that the 14-year story has been one of continued and unbroken success by reason of this preference for British aeroplanes. Although the principle paid off in the end, there was a period during which the Corporation suffered damaging competition from other European airlines which were operating more advanced equipment. The Viking, introduced as an interim type in September, 1946, had to maintain British prestige on the short-medium-haul services until March, 1952, when the first genuine post-war British transport aeroplane, the Ambassador (B.E.A.'s Elizabethan), entered service on the Paris run. Meanwhile, the Convair 240 had been in operation for nearly three years and it was a year later still before the Viscount—developed from the initial prototype 630 version into its larger and more practical 701 production form—entered service to back up the Elizabethan as a traffic magnet.

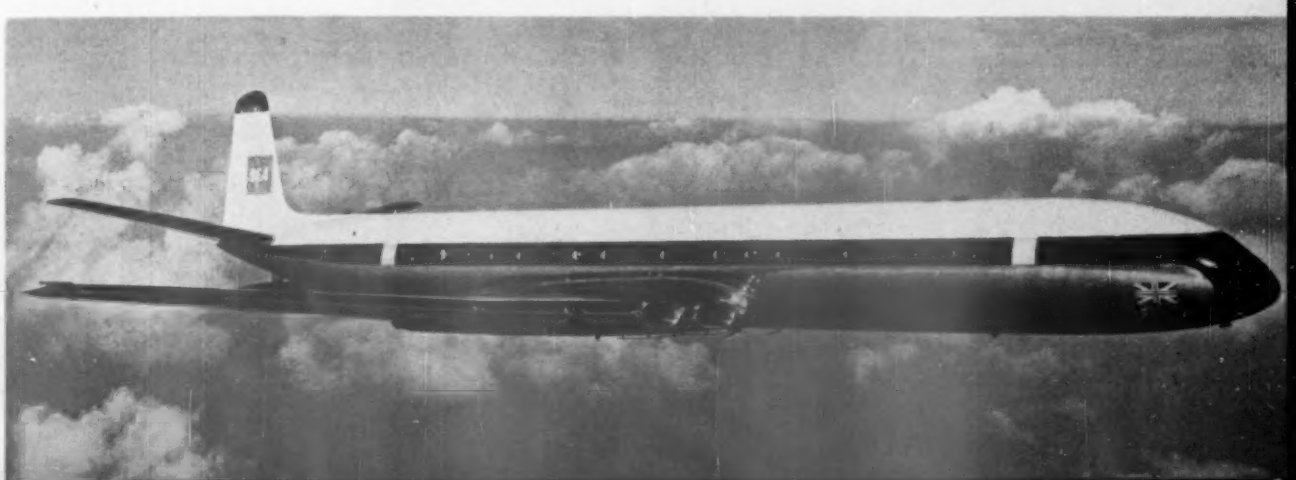
The comparative lateness of the introduction of these two new types was not inevitable—but it was understandable in view of the amount of work that had to be done and of the policy questions which bedevilled the programmes concerned. Both the Ambassador and the Viscount had been initially planned as much less capacious aircraft and the final production versions of each were much-developed variants of the original prototypes. There was, in fact, a period during 1947-48 when it looked as if the Viceroy (as the Viscount was then known) might never see airline service in any form, such was the effect of the temporary doubts felt about the turboprop principle.

The Ambassador's manufacturers, Airspeed, had been given a verbal production go-ahead in December, 1947, and an order for the finalized, developed version had been placed in September, 1948. Meanwhile, the Vickers 630 prototype had also flown and experience with it was already causing changes of mind on all sides. The decision to order the larger B.E.A.-sponsored 701 development of the 630 was reached in July, 1949, and the final order for 20 (later increased to 27) was placed in August, 1950.

In that year the thinking about turboprop operations had been further influenced for a number of people by the experience gained on the series of scheduled services to Paris and Edinburgh with the 630. Here was something unusual in the way of airline travel-comfort and speed. Before the 701 actually went into service on the London-Rome-Athens-Cyprus run in April, 1953, B.E.A. had already ordered (in February) 12 of a long-fuselage derivative—the first of the 800 series.

An interesting point is that the eventual appearance of these new-generation aircraft—the Elizabethan and the Viscount—did not cause any very marked upward swing of the passenger, passenger-mile or ton-mile curves. Obviously, without the new fleets the curves would have tended to flatten out, but the fact that traffic increases remained fairly constant during the years shows that no single development, however important, will, by itself, alter public habit. Passenger traffic-growth, like freight-growth, depends on a multitude of factors. The effects of the new fleets, and of the Viscount in particular, may explain some of the upward ton-mile trends in 1953-54 and in 1955-56—but a much more vigorous upsurge in freight ton-miles, starting in 1955-56, has no such relatively simple explanation.

The build-up of capacity ton-miles to meet the expected annual increase in ton-miles sold has shown some significant features during the years. Whereas, for instance, in March, 1949, a total of 83 line aircraft, including 37 Vikings and 23



DC-3s, was necessary to offer an annual capacity of about 26 million ton-miles, 10 years later a fleet average of only 33 more, or a total of 116 line aircraft, was required to provide a capacity of 181 million ton-miles—or seven times more. The Elizabethans, the Viscount 701s and, later, the 800 series Viscounts have each been progressively capable of doing very much more work per hour of operation.

In the 1957-58 accounts (the following year's results were unrepresentative because of the effects of the recession) the Viscount 701s and 802s and the Elizabethans were shown as the aircraft in the combined fleet which earned the operating profit to offset the losses incurred by older or smaller-capacity aircraft. By comparison, in 1952-53 the only aircraft to show an operating profit were those which had been chartered, and the nearest to breaking-even were the DC-3 freighters.

So it is not surprising that the first profitable year for B.E.A. was 1954-55, when the Corporation had 20 Elizabethans and an average of 21 Viscounts in line use.

Altogether, the Corporation has—excluding D.H. Rapides (45 of which were in use in March, 1947) and Avro 19s—put into service or ordered some 190 British aircraft since it started operation in 1946. These have included 49 Vikings, 20 Elizabethans, 27 Viscount 701s, 24 V-802s, 19 V-806s, 20 Vanguards, seven Comet 4Bs and 24 D.H.121s. The Vanguards are to enter service in July and the Comets are due to enter service today, April 1.

One of the Ju 52s which were operated for a short time is seen here during a lighthouse supply-dropping operation early in 1947.

At one time B.E.A. had 45 D.H. Rapides in operation. Below is one of the DC-3s which have worked through B.E.A.'s 14-year life.

Right, the first production Ambassador/Elizabethan, which is now fitted with Eland turboprops as a Napier-owned flying test-bed.

B.E.A.'s First Turbojet

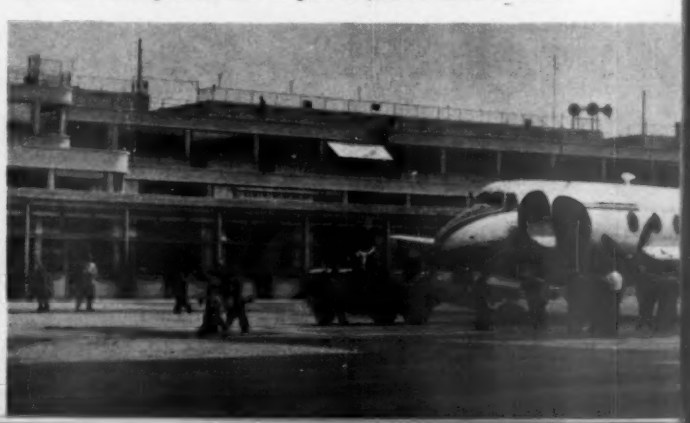
The Comet 4B is by way of being something new and different for B.E.A. Not only is it the Corporation's first turbojet, but it is the first time that a turbojet has been put into service by an essentially short-haul regional operator. Even though B.E.A. will, for the most part, use the aircraft for the longer sectors in its network, these sectors are short by turbojet operating standards, yet the prospective work-capacity of the Comet is shown by the fact that the Corporation expects that seven of these aircraft will provide something like 17% of the 1960 summer-season seat-miles.

Short sectors planned for the Comet are from London to Dusseldorf (270 n.m., 1 hr. 5 min.) and Frankfurt (353 n.m., 1 hr. 15 min.); the longest sectors will be those from London to Malta (1,135 n.m., 2 hr. 45 min.) and to Moscow (1,360 n.m., 3 hr. 30 min.). In addition, there are short sectors such as Oslo-Stockholm (213 n.m.) and Athens-Istanbul (300 n.m.) on trunk routes. Obviously, on these shorter sectors—and, in particular, on those which form parts of trunk services—the efficiency of flight planning and refuelling drills will be vitally important, not only to ensure that turn-round times can be kept to a minimum, but that the most practical flight-plan is chosen for the particular conditions.

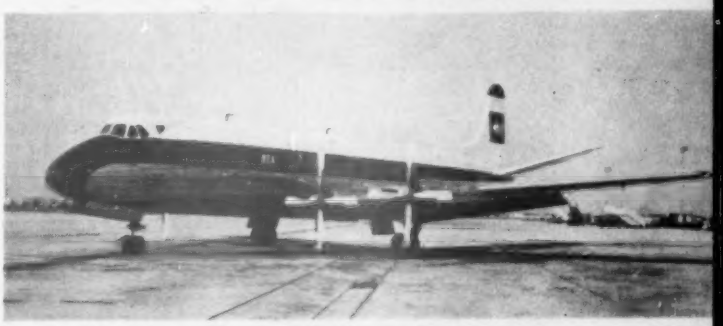
From the moment when B.E.A. decided to order the Comet 4B, very close attention has been paid to the procedures involved and a great deal has been learned about the cruising and other characteristics of this "clipped-wing" lower-level version of the Comet during familiarization and crew-training work. For instance, attempts at slow-speed cruising for maximum range at altitudes over, say, 31,000 ft. proved to be unproductive because of the power required to beat the higher induced drag, and for the same reason the use of cruising altitudes above 35,000 ft. does not appear to pay off.

For flight-planning B.E.A.'s Comet Flight has developed a set of tables which are similar in general principle to those used for Viscount operations and, given the mean forecast wind component and temperature data, this part of the planning procedure can be completed in less than 10 minutes. The fuel requirements and flight times for the distance to destination, and thence to the chosen alternate, are read off the tables and standard holding and start/taxi allowances are added to give the total fuel required.

As an example, the flight-time and fuel requirement for a sector distance of 1,000 n.m. with a mean favourable wind component of 30 knots might be read off as 2 hr. 12 min. and 11,250 kg. respectively, and those from destination to alternate (150 n.m., wind—20 knots) as 26 min. and 2,770 kg. To this fuel would be added allowances of 3,150 kg. for 45 min. holding at 5,000 ft. with de-icing allowances, and of 350 kg. for start and taxi, making a total of 17,520 kg. "Howgozit" plots and E.T.A. calculation would be made as soon as the Comet had reached cruising altitude and at 20-minute intervals thereafter. The tables also give the fuel in gallons (B.E.A. use a constant



One of B.E.A.'s D.H. Herons used on some Scottish services.



A Viscount 800 in the new B.E.A. styling.

specific gravity) for the benefit of the refuelling supervisors.

B.E.A.'s Comet flight-deck crew consists of three pilots, a captain and two first officers, one of whom is stationed at the engineering panel where the primary responsibility is that of fuel management and calculation. All three are trained on the panel, but the position is normally taken by one of the first officers, who, in consequence, need to do more practice time at the panel during the simulator course. Base training (conversion flying) is done at Stansted. Necessary line-training completion is based on the number of sectors flown rather than on logged hours on different routes—which is reasonable enough.

Conversion to the Comet does not appear to present any particular difficulties. As Capt. G. T. Greenhalgh, the Flight's manager, puts it, the Comet is very easy just to fly, but needs concentration to fly as it should be flown for the best results. The take-off and initial climb techniques are soon mastered and the only prospectively dangerous handling differences between the turbojet and propeller-driven aircraft are those concerned with the simple fact that the turbojet gains no lift-increase advantage when power is applied to stretch a final approach. Whereas a propeller-driven aircraft has immediate slipstream advantage, the turbojet only obtains more lift as the speed is increased to provide it—and that takes time. Hence the need to watch for signs of speed "decay" during final approach; once a few knots have been lost, getting them back is a slow business.

However, given the correct drill—and five knots surplus speed in rough conditions—the Comet can be held very accurately during final approach. The B.E.A. technique involves the use of full flap (80 deg.) only as the threshold is reached. The thrust required to hold a steady descent at about 135-140 knots with 40 deg. of flap is the same as that needed to hold the same rate of descent with 60 deg. of flap at an appropriately lower speed (about 125-130 knots) from some 600 ft. on finals.

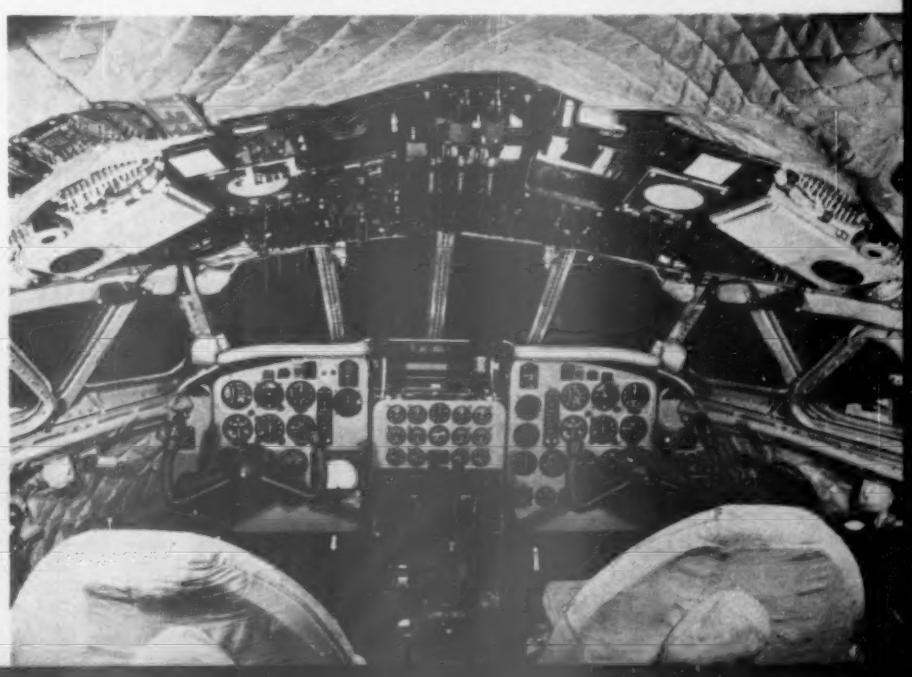
Various methods have been tried for the reduction of perceived noise levels after take-off out of L.A.P. The matter has been of considerable importance to B.E.A. because of the need to keep the measured levels down to a figure which will satisfy the Ministry of Aviation on night take-offs—in particular for the Moscow run. Since only a certain maximum noise is permissible by night the Comet Flight has developed its technique to meet this limitation in all conditions—the philosophy being that if a suitable method can be applied in more difficult night-time conditions then it might equally well be applied by day.

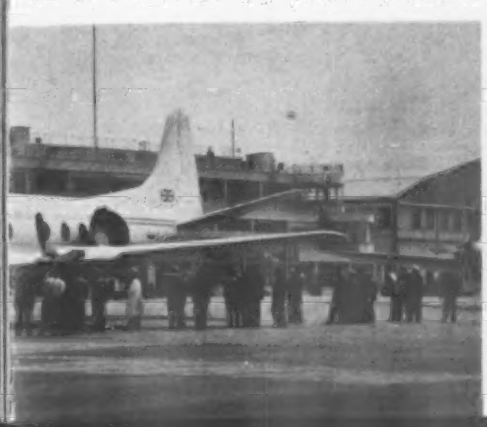
B.E.A.'s developed method is to hold take-off power to 900 ft. and then to reduce the r.p.m. to 7,000 for the climb to the initial A.T.C. clearance height, which may be 3,000 or 4,000 ft. The initial climb speed is about 150 knots increasing to 170 knots above 900 ft. With the rapid acceleration of the Comet during the later part of the run, the whole business of take-off and of settling into the very steep initial climb happens very quickly, with V1, V_R and V2 coming up apparently almost together and the nose being raised higher and higher to keep the speed down during the initial full-power climb. But pilots soon accustom themselves to the quick-fire programme involved.

So far as relative training times are concerned, it is early yet to estimate the values of different bases of experience, but certain advantages are enjoyed by pilots who have been flying Viscount 800s. These have experience of the Smiths Flight System, of the S.E.P. 2 auto-pilot, and of all-pilot (two-crew) operations.—H.A.T.

On the right is the flight deck of the B.E.A. Comet 4B. The Decca display head will be at the top of the central panel.

Below, the prototype Viscount 630 is seen on the apron at Le Bourget, Paris, during the series of scheduled services operated by B.E.A. in 1950.





The Fighting Services

W.R.A.F. Appointments

GROUP OFFICER J. L. A. CONAN DOYLE, O.B.E., has been appointed Deputy Director of the Women's Royal Air Force. Since April of last year she has been Inspector of the W.R.A.F. in which post she is succeeded by Gp. Off. L. H. Turner, O.B.E.

Gp. Off. Conan Doyle joined No. 46 (County of Sussex) R.A.F. Company of the A.T.S. in 1938, and was commissioned in the Administrative Branch of the, then, W.A.A.F. in 1940. Later she became the W.R.A.F. Staff Officer at various Headquarters within Fighter Command and at Headquarters, No. 28 Group, in London. In 1948 she went to Germany as W.R.A.F. Staff Officer and subsequently served at Headquarters, Technical Training Command, and the Air Ministry. From April, 1954, to June, 1956 she was Inspector of the W.R.A.F. and afterwards was appointed Commanding Officer of R.A.F. Hawkinge until she again became Inspector of the W.R.A.F. in 1959.

Gp. Off. Turner has been Deputy Director of the W.R.A.F. since February, 1957. She joined the W.A.A.F. in 1939 and was commissioned the following year. Until 1946 she held appointments at R.A.F. Station and Group Headquarters and then went to the Directorate of Postings in the Air Ministry. She was appointed Inspector of the W.R.A.F. in 1950; W.R.A.F. Staff Officer at Headquarters, Home Command in 1952; and Command Welfare Officer to the Second Tactical Air Force in Germany in 1954.

Retiring from the R.A.F.

WG. CDR. A. E. SIMS, O.B.E., L.R.A.M., A.R.C.M., the R.A.F.'s Organizing Director of Music, who is shortly to retire, will make his last public appearance in his official capacity on Apr. 6. On that occasion he will be joint conductor with Sir John Barbirolli, at the fifth annual R.A.F. Anniversary Concert, by the Hallé Orchestra and the Central Band of the R.A.F.

In a military musical career lasting half a century, Wg. Cdr. Sims has spent 39 years in the R.A.F. He joined the Band of the Royal Marines as a boy in 1911 and 10 years later joined the Central Band of the R.A.F.—then a year old. He spent 14 years as Director of Music at the R.A.F. College, Cranwell, and when he was appointed Organizing Director of Music in 1949 he formed the R.A.F. School of Music at Uxbridge.

Sqn. Ldr. J. L. Wallace, O.B.E., L.R.A.M., A.R.C.M., P.S.M., is to succeed Wg. Cdr. Sims as the R.A.F.'s Organizing Director of Music. He has been Director of Music of the Central Band of the R.A.F. since 1957.

Exit the Venom

WITH the recent return of No. 208 Squadron (Sqn. Ldr. R. Ramirez) from Eastleigh, Nairobi, to Stradishall, to re-equip with Hawker Hunter FGA 9s, the de Havilland Venom has completed its operational career with the R.A.F. The Venom F.B. 4s of No. 208 Squadron have been a familiar sight over Kenya for the past year, and in its seven years of operational service the type has operated in the U.K., Germany, Cyprus, Jordan, Iraq, Aden, Malaya and Hong Kong, as well as East Africa.

The Venom F.B. 4, which was the final production variant, was powered by a 5,150-lb.s.t. D.H. Ghost 105 engine, and had a maximum speed of 519 knots at sea level. It achieved M=0.82 at 30,000 ft., and an initial climb of 7,230 ft./min.

With wing-tip tanks, bringing the total fuel to 489 gal., and carrying two 500-lb. bombs and eight 60-lb. R.P.s, the Venom 4 weighed 15,310 lb., and had a patrol duration of 2.25 hr. at 20,000 ft. Fixed armament was four 20-mm. Hispano cannon.

With its all-round improvement in performance and offensive capability, the Hunter 9 will confer a much greater measure of operational potency to No. 208 Squadron. This may return to Nairobi with its new aircraft before joining No. 8 Squadron —the first Hunter 9 unit—at Khormaksar, Aden, for operations in the Arabian Peninsula.

The Problem of Manpower

ONE of the biggest problems facing the R.A.F. in the next few years would be that of manpower—the right kind of manpower—said Air Marshal Sir Hugh Constantine, A.O.C.-in-C., Flying Training Command, at Leeds University Air Squadron's annual dinner on Mar. 15. The R.A.F. wanted quality and it would make a tremendous difference to the future of the Service if it could get its fair share of university men; but there was plenty of competition, especially from industry.

Air Marshal Sir Hugh Constantine presents the Casson Trophy to Pilot Officer P. G. Robinson.

The demand for "flying types" was increasing. In fact, Flying Training Command was preparing to train more pilots and navigators to meet requirements laid down by the Government, especially for Transport Command.

Sqn. Ldr. A. V. E. Palmer, C.O. of the Leeds University Air Squadron, said the total of 2,200 hours flown last year was a record for the Squadron, which has four aircraft. Their move from Yeadon to R.A.F. Church Fenton had been of benefit to all concerned, he affirmed.

At the dinner Air Marshal Constantine presented the Casson Trophy for 1959-60 to Acting Pilot Officer P. G. Robinson, of Coleshill, Warwickshire. This trophy is awarded annually to the best all-round cadet.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. G. ff. Powell-Sheddon, D.S.O., D.F.C., to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr. M. E. H. Dawson, D.F.C., D.F.M., to Headquarters for training duties; Wg. Cdr. D. J. Furner, D.F.C., A.F.C., to Headquarters for plans and policy duties.

Fighter Command: Gp. Capt. J. B. Tait, D.S.O., D.F.C., to Headquarters, No. 13 Group, as Senior Officer in charge of Administration; Capt. P. R. Walker, C.B.E., D.S.O., D.F.C., to the School of Land/Air Warfare, Old Sarum, as Chief Instructor, Air Defence Wing; Wg. Cdr. L. C. Lambert, A.F.C., A.F.M., to the Southern Regional Air Traffic Services Centre, Uxbridge, as Regional Controller and to command, with acting rank of Gp. Capt.; Wg. Cdr. W. J. Gregory, D.S.O., D.F.C., D.F.M., to R.A.F. Bawdsey for operations duties; Sqn. Ldr. S. A. Vialls to Headquarters, No. 11 Group, for operations duties with acting rank of Wg. Cdr.; Sqn. Ldr. I. T. A. Murchie to the Central Fighter Establishment as Senior Technical Officer, with acting rank of Wg. Cdr.

Transport Command: Wg. Cdr. M. R. Attwater, D.S.O. D.F.C., to R.A.F. Benson, to command the Administrative Wing.

Technical Training Command: Wg. Cdr. W. A. Covill, O.B.E., to the Officers' Advanced Training School, Bircham Newton, as Group Director; Wg. Cdr. E. S. G. Cropper to No. 1 School of Technical Training, Halton, as Officer in charge of Basic Studies; Wg. Cdr. F. D. Greeves to the R.A.F. School of Education, Uxbridge, as Chief Instructor; Wg. Cdr. R. J. C. Farrell to Headquarters for training duties.

Maintenance Command: Wg. Cdr. J. D. Mallinson, A.F.C., to Headquarters as Command Armament Officer; Wg. Cdr. E. A. L. Wakely to Headquarters, No. 40 Group, for planning duties.

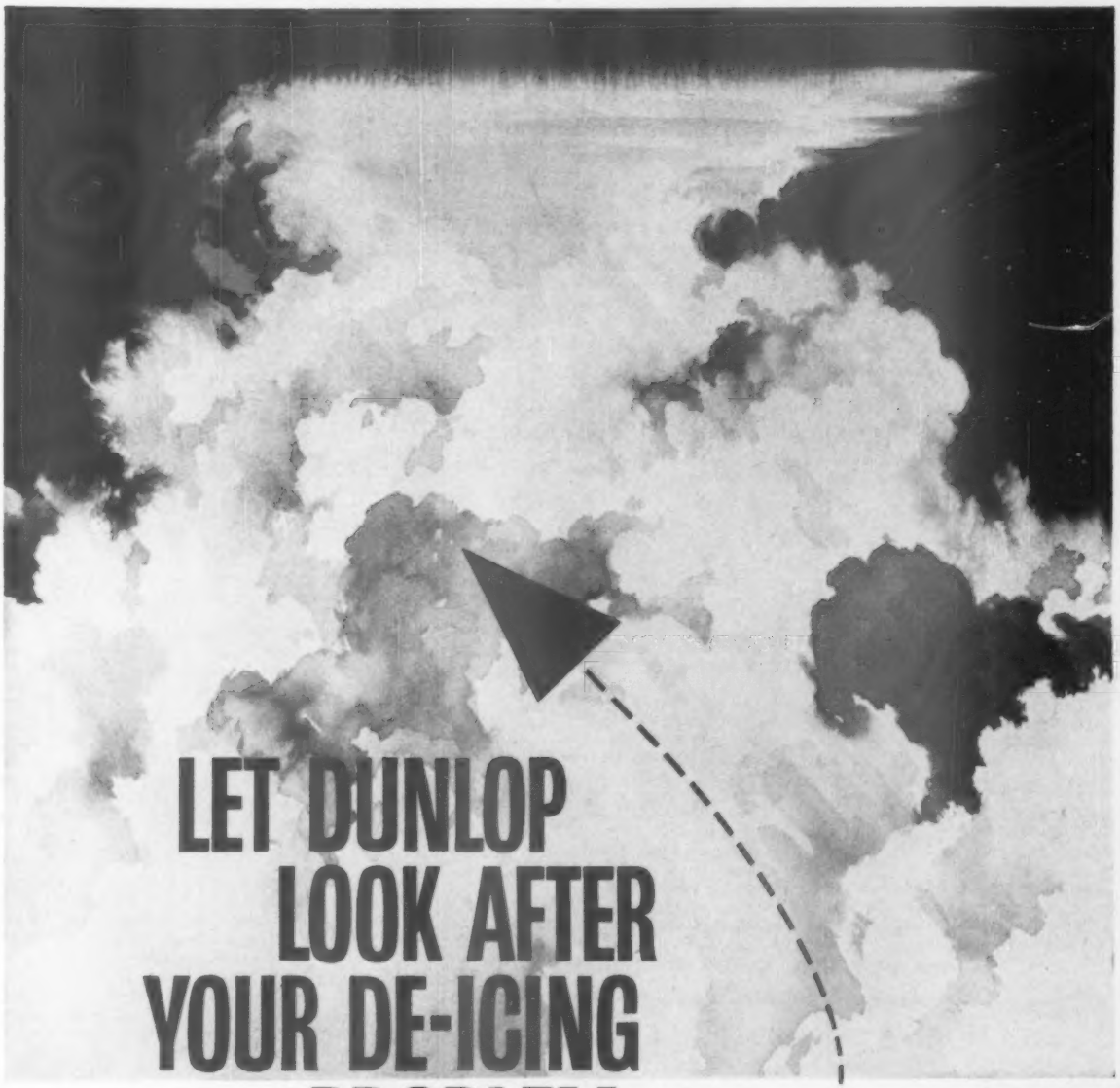
Middle East Air Force: Wg. Cdr. M. L. Formby to R.A.F. Nicosia, as Senior Technical Officer.

Other Appointments: Gp. Capt. R. K. Jeffries, O.B.E., to the Ministry of Aviation; Sqn. Ldr. R. J. Edmonds, D.F.M., to the Ministry of Aviation, with acting rank of Wg. Cdr.; Gp. Capt. G. L. S. Griffith-Jones, C.B.E., M.A., to Allied Air Forces Northern Europe as Chief Signals Officer; Wg. Cdr. S. M. Mackay, A.F.C., to Allied Air Forces Central Europe for operations reconnaissance duties.

Reunions

Bristol University Air Squadron Dinner.—The 7th Annual Dinner of the Bristol University Air Squadron is to be held in the Hawthorns Hotel, Bristol, on Friday, Apr. 29 at 19.30 for 20.00 hrs. All members and ex-members are invited to attend and should contact the Mess Secretary, Officers' Mess, B.U.A.S., Royal Air Force, 12 Whiteladies Road, Bristol, 8.

No. 609 Squadron Reunion.—The annual dinner and reunion of No. 609 (West Riding) Squadron Association will be held in Leeds on May 7. Anyone interested who does not already receive regular bulletins should write to Sqn. Ldr. D. Shaw, "Wheatfield," Wood Lane, Leeds, 6, for further information.



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Astronautics and Missiles

Anniversary Probes

In this note, S. W. GREENWOOD, M.Eng., A.M.I.Mech.E., A.F.R.Ae.S., *examines the prospects for solar or inner planet probes which return to Earth after one year in orbit.*

THE early exploration of space is best conducted by launching probes on long journeys that range both outward from the Sun and inward towards it, without in the first instance facing the problem of entering orbits around other planets or their moons. These views were presented in an earlier article by the author,* and some information was given on the types of orbit and the vehicle performance required.

A most suitable orbit, from the point of view of travelling the greatest distance relative to the Sun for the minimum vehicle performance requirement, is an ellipse touching the Earth's orbit. Some ellipses take a whole number of years to complete, for journeys outside the Earth's orbit; and some a fraction of a year, for journeys within the Earth's orbit. These are particularly interesting in that they permit subsequent meeting of the Earth and the vehicle at the point on the Earth's orbit where the vehicle was first launched. In other words, they are suitable orbits to select in cases where recovery of the probe is intended.

All the journeys outside the Earth's orbit involve more than one year away from base. One single journey within the Earth's orbit involves exactly one year, all the others involve two or more years. The journey taking one year is the six-month orbit travelled twice. This six-month orbit is attractive on a number of counts, and these are examined in this note.

Curiously, although it is associated with the shortest total journey time, compared with the recoverable orbits within the Earth's orbit, it involves the greatest distance from Earth towards the Sun, as will be seen from a reference to the earlier article. From the well-known relationship:—

$$t = \left(\frac{D+1}{2}\right)^{3/2}$$

where: t is the time in years for completion of one orbit and D is the distance of perihelion from the Sun in Astronomical Units

the perihelion distance is seen to be 0.26 Astronomical Units from the Sun for a half-year orbit.

The orbit is shown in the accompanying figure in relation to the inner planets. The significance of the closeness of the approach to the Sun at perihelion is emphasized by the nature of the weakening of the solar radiation with increasing distance from the Sun. In the region of perihelion the intensity of the radiation will be $(1/0.26)^2$, or 14.8, times as great as it is near the Earth. The incident energy at perihelion will thus be about 1.87 kW/sq. ft. Covering a distance of nearly three-quarters of the space between the Earth and the Sun, the orbit would be extremely suitable for solar research.

It will be seen from the figure that the orbit crosses at two points the orbits of each of the inner planets, Venus and Mercury. Although these orbits are drawn in one plane in the figure, the inner planets have orbits that are inclined by a few degrees to the ecliptic, the plane of the Earth's orbit.

In addition, the orbits of all planets are elliptic. The ellipticity of the orbit of Venus is small, and its orbit is, therefore, shown as a circle. That for the Earth is rather larger, and for Mercury it is pronounced. For these planets, the boundaries of the orbits are shown.

By careful control of the six-month orbit journey, it should be possible to arrange a launching date so that one of the inner planets was fairly closely approached once on the one-year journey. At less frequent intervals the opportunity for a close look at both planets would occur.

Our ignorance of conditions on the inner planets is considerable. Venus has an atmosphere that is substantially opaque when viewed from the distance of the Earth. Mercury is relatively small, and when illuminated by the Sun is on the far side of the Sun to the Earth, which does not assist observation. The probe orbit will be seen from the figure to offer extremely attractive opportunities for observing the sunlit face of Mercury.

Compared with the cosmic rockets launched to date, the performance requirements for such a vehicle would be fairly high. Lunik I, Pioneer IV and Pioneer V reached velocities of about 7 miles per second outside the Earth's atmosphere. For entry into the six-month orbit the corresponding figure would be 9.6 miles per second.

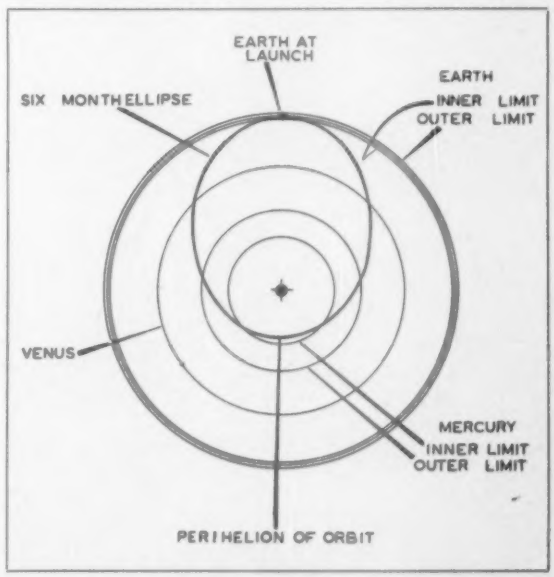
To launch a comparable payload, an additional booster stage would be involved, having a mass several times that of the original rockets. Yet the figure is not beyond feasibility, and the orbit is clearly worth consideration in planning the next generation of space probes.

Launching from Orbit

If techniques involving launching from Earth-satellite orbits become available, then the launching velocity requirement would drop to 4.7 miles per second. Recovery of the vehicle would call for twice this, or 9.4 miles per second. This is a similar figure to that for launching from the Earth and for no recovery.

Apart from the desirability of effecting recovery of all or at least part of the payload, the closeness of the approach of a non-recoverable probe at the end of a year's flight would be of considerable value in facilitating transmission of stored information from the probe to the Earth.

In one year away from Earth, it is possible to make two complete orbits in a region covering three-quarters of the space between our planet and the Sun, and to pass at least one of the inner planets closely. The anniversary of the launching of such a vehicle would be commemorated in a significant way by its return. It is quite possible that a politician, or a scientist with a feel for the popular pulse, may foresee a purpose in launching such a vehicle *on* a popular anniversary in the expectation that it would return to share in, and thus enhance, the next.



The six month ellipse in relation to the inner planets.

* "Solar-System Reconnaissance," S. W. Greenwood, THE AEROPLANE, January 23, 1959.

Prelude to Atlas

Details of a pioneer rocket test-vehicle

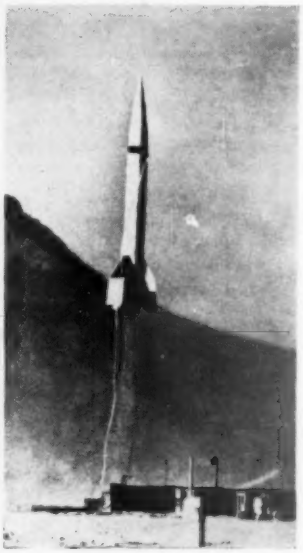
EARLIER this year, President Eisenhower announced that the Atlas ICBM had been proved capable of sending its ballistic warhead a distance of 5,500 miles, putting it down within two miles of an assigned target. No fewer than 14 missiles launched over the Atlantic Range from Cape Canaveral, he said, had been successful in recent tests. Coupled with the news that the first Atlas squadron had been formed and was operational at Vandenberg Air Force Base, this was considered adequate proof that if the United States were lagging in space-exploration, it was at least matching the U.S.S.R. in terms of the ballistic-deterrent.

The history of the Atlas has now been related in an interesting book* just published in the United States, which traces the ICBM concept back to October 31, 1945. On that day the U.S. Air Force, through its Air Technical Service Command, issued letters to the U.S. aircraft industry, inviting proposals on a 10-year programme of research and development in four classes of missiles of 20 to 5,000 miles range.

One of the companies that took up the challenge was the Consolidated Vultee Aircraft Corporation (Convair), which was then at work on the giant B-36 bomber. However, the company's Vultee Field division, at Downey, California, had been concerned with the subsonic Lark surface-to-air missile, being developed for the U.S. Navy, and were eager to consider appropriate designs for long-range missiles.

By January, 1946, two schemes had been prepared for consideration by the Air Force. One was a subsonic jet-propelled pilotless aircraft; the other a supersonic ballistic rocket. Convair suggested that design studies should be put in hand to determine the respective merits of the two very different schemes; and in April, the company received a $1.4 million contract to begin a year's comparative investigation, purely to give the U.S.A.F. some idea of how such weapons might develop in perhaps five to 10 years.

It seems that the ballistic rocket was an early favourite with the Convair study group, and this led to the birth of Project MX-774 under Mr. K. J. Bossart.



One of the three MX-774 test-vehicles developed by Convair on a meagre budget in 1946-47 to prove new techniques of rocket construction, later incorporated in the Atlas ICBM.

Mass-ratio Problems

One of the principal aims was to improve the mass-ratio by eliminating as much dead-weight as possible from the rocket structure. The MX-774 has been described as "an Americanized V-2"; it used the same propellents (liquid oxygen and alcohol), but apart from one or two features it was actually quite different.

Structurally, it represented what Americans call a "breakthrough." The internal tanks and external skin of the V-2 were eliminated in favour of tanks which were integral with the rocket structure, the fuel being separated from the oxidant by a single bulkhead.

The idea that the whole rocket structure must re-enter with the warhead, involving severe aerodynamic loading, skin-heating, and appropriate robust construction, was replaced by the simple procedure of separating the warhead from the rocket afterbody and making only the former robust enough to re-enter. Use was also made of nitrogen gas, which fed the propellents to the pumps, for it was reasoned that gas pressure could be used to stiffen the tank walls in place of metal stiffening.

Thus, although the light-alloy walls of the MX-774 were structurally inadequate by themselves, they became an efficient load-carrying structure when pressured with nitrogen. These and other weight-saving measures gave the MX-774 a mass-ratio which was about three times as good as that of the V-2.

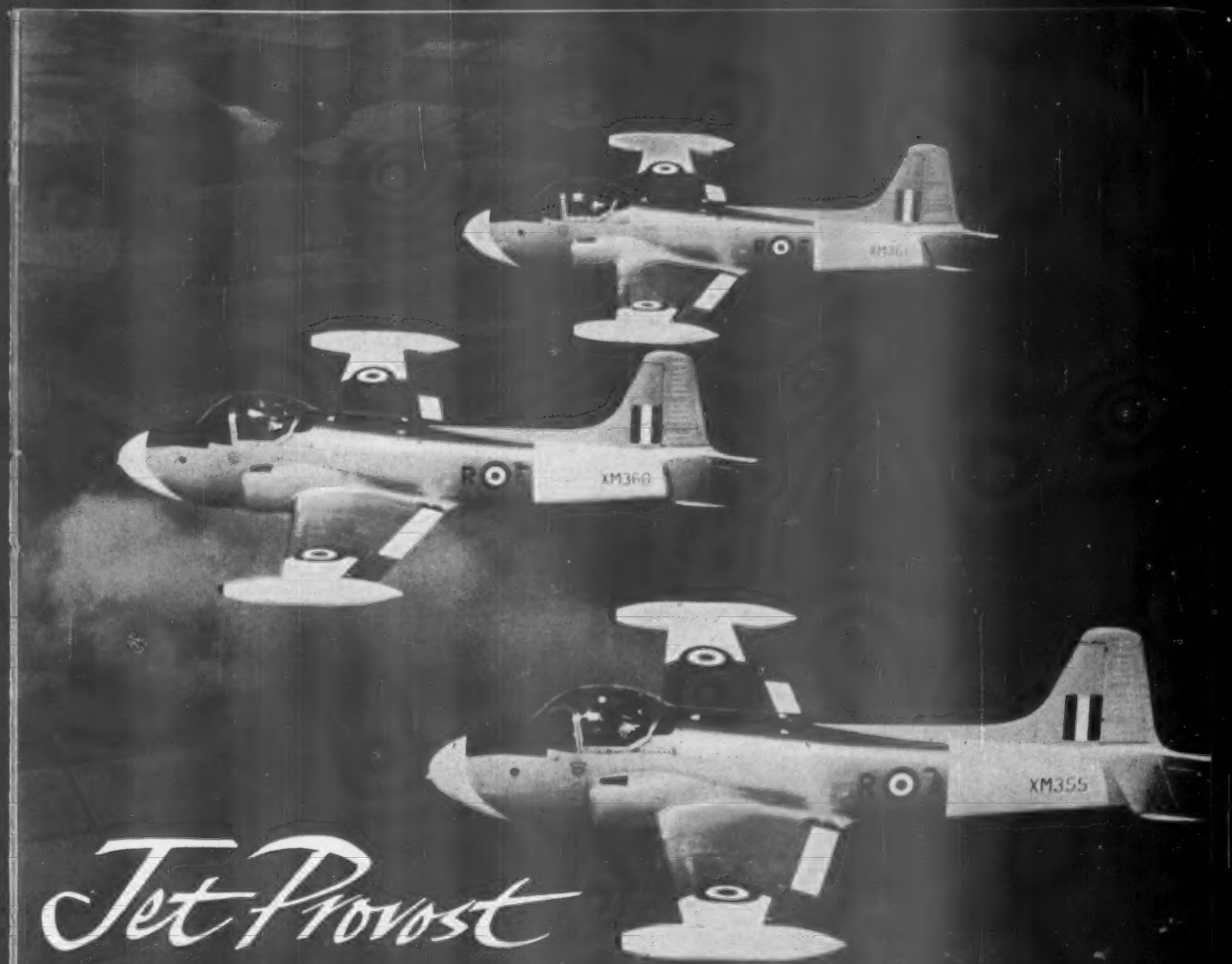
To convert these ideas into "hardware," Convair secured an additional $493,000 in Jun., 1946, making a total of $1,893,000 with the money already obtained under the U.S.A.F. study contract. Thus, work began on the first of a proposed experimental quantity of 10 test-vehicles.

A contract was placed with Reaction Motors, Inc., to provide

(*Continued on page 411*)

* "Atlas: the Story of a Missile," by John L. Chapman. Harper and Brothers, New York. $4.00.

An early Atlas test-vehicle rises from the launching platform at Cape Canaveral. The first Atlas was test-fired on June 11, 1957.



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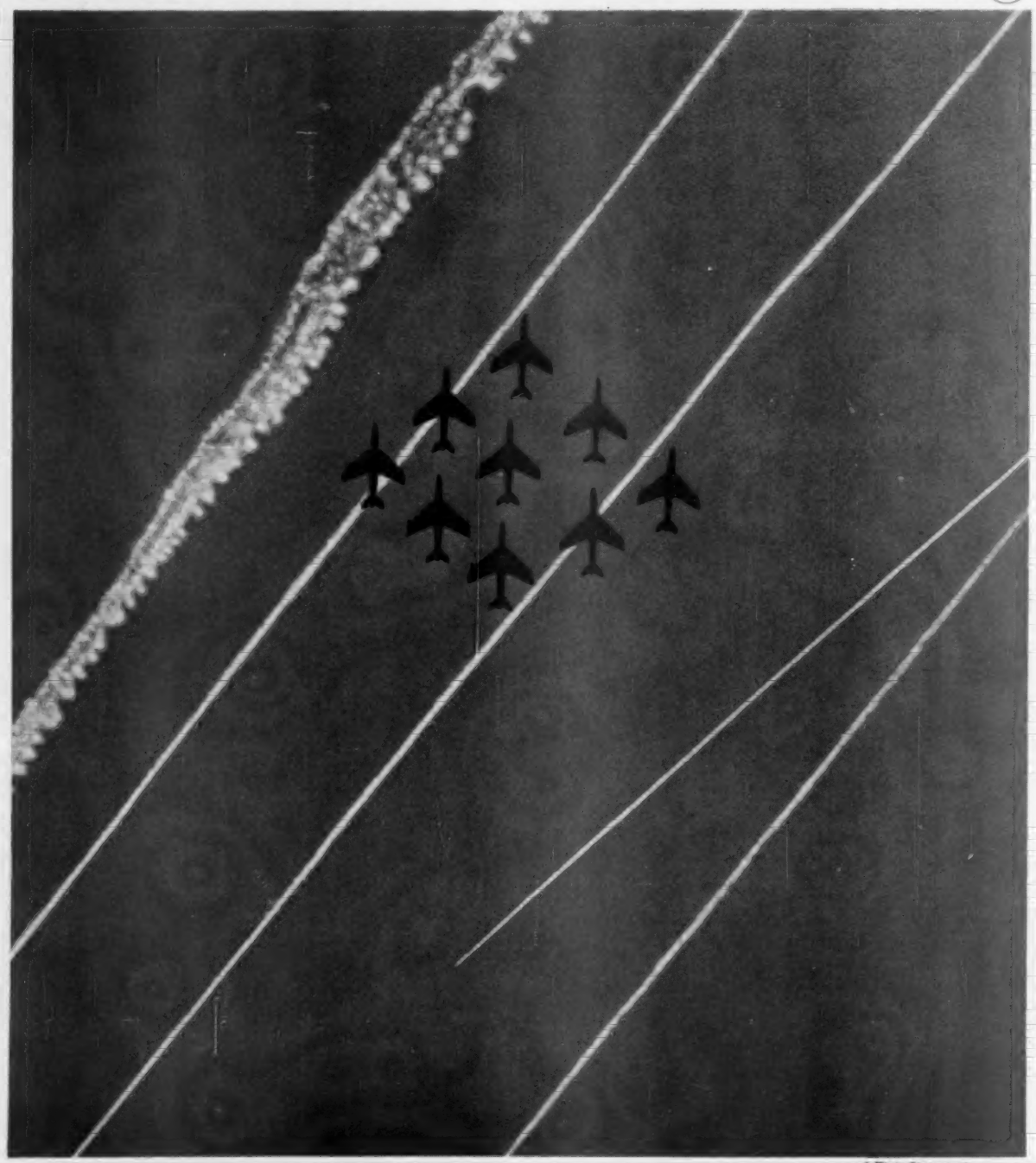
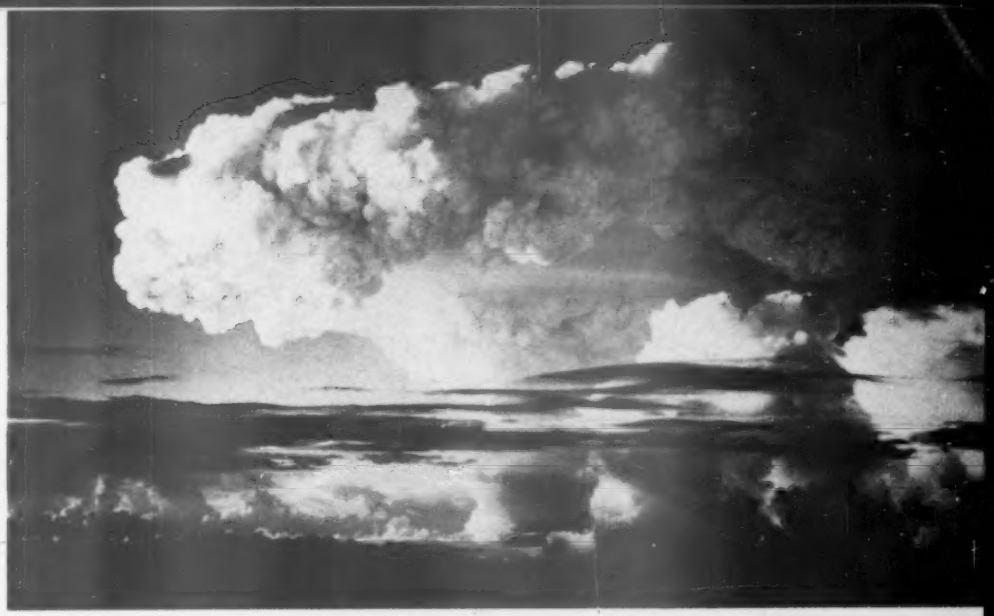


A Flight Photograph



When the Americans tested their thermonuclear device in the Marshall Islands on Nov. 1, 1952, the test-island "Elugelab" completely disappeared. But the bomb was too massive to be carried by a ballistic missile.

(Continued from page 410)

a four-chamber rocket engine based on their experience with the 6,000-lb.s.t. unit developed for the Bell X-1 research aircraft. Convair required a rocket engine of 8,000 lb.s.t. with swivel mounts permitting each of the four thrust chambers to be deflected in a single direction during flight. The chambers were to be swivelled by rods under the control of an autopilot to maintain the rocket's stability.

Oddly enough, the only major feature adapted from the V-2 was the fins, the shape of which Convair retained in order to reap the benefits of German wind-tunnel experience. Some time later, Convair were informed by Dr. Rudolf Hermann, a V-2 aerodynamicist, that the V-2's fins were "that shape" principally because of a need to keep the missile compact for transport through narrow German railway tunnels. Aerodynamics had been a secondary consideration.

Project Cancelled

Construction of the MX-774 proceeded throughout the latter half of 1946 and early 1947. Meanwhile, Convair's design study for a pilotless aircraft-type missile was cancelled by the U.S.A.F. in favour of a similar project by Northrop, which eventually led to the Snark SSM.

Then, on Jly. 1, 1947, an economy decision led to the cancellation of the MX-774 itself—just as the first test-vehicle was nearing completion. However, Convair were permitted to use up funds already allocated by the U.S.A.F. which enabled three missiles to be completed.

After static tests at a site at Point Loma in San Diego, the first MX-774 was fired at White Sands, New Mexico, only to rise 6,200-ft. and fall back to explode just 200-yd. from the blockhouse. The motors had cut off prematurely. The intention had been to fire the missile to a height of about 100 miles, to separate the nose-cone by an explosive charge near the peak of the trajectory, and to recover the missile afterbody by means of a 40-ft. parachute. Inside the rocket were recording instruments, including a sequence camera intended to photograph dials on an instrument panel throughout the flight.

During its brief life, the missile had, under the influence of its swivelling motors, demonstrated perfect stability at low speeds, and subsequently the tail fins on the MX-774 were regarded merely as supporting structures for the vehicle on the firing pad. In the Atlas they were omitted altogether.

The second MX-774 reached a height of 29 miles, but again suffered propulsion failure, as did the third which rose 30 miles on Dec. 2, 1948. Camera records showed that the fault had been due to vibration. This had affected a "floating" switch in the pump turbine, which had reduced nitrogen pressure and allowed the liquid oxygen valve to close.

The problem had been solved, but not before the three precious test-vehicles had gone and with them all the U.S.A.F. funds.

Convair kept interest in the long-range ballistic missile alive during 1949-50 using its own money, but this could support no more than paper studies. Bossart and his team were convinced that the techniques evolved for the MX-774 were the key to success, but to travel 5,000 miles the missile would have to be a step rocket.

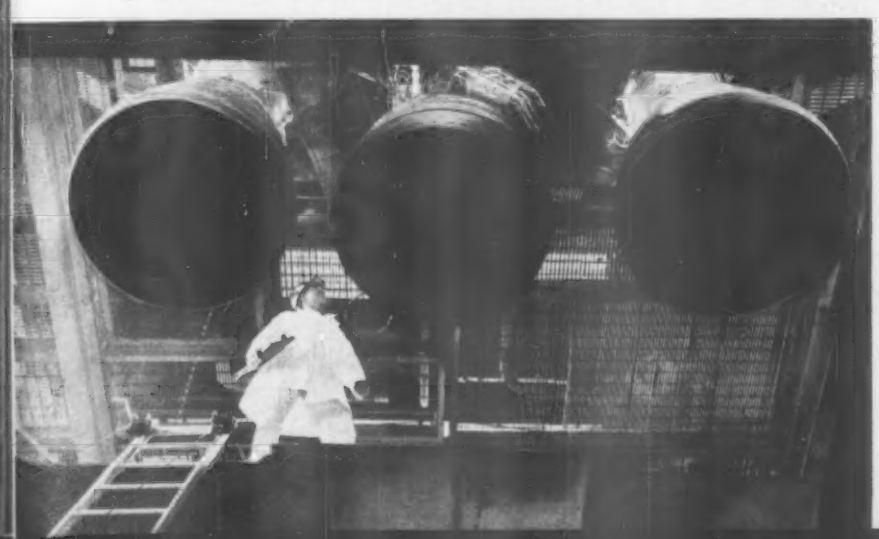
CONVAIR MX-774 (Hiroc)

Length	31-ft. 7-in.
Diameter	30-in.
Weight, dry	1,200-lb.
Thrust	8,000-lb. × 75 sec.
Propellent	liquid oxygen/alcohol
Altitude	100-miles

While working on the staging problem, the Convair team hit upon the idea of making one lightweight, pressure-stabilized tank serve two stages, the thrust chambers being arranged in such a way that some could be jettisoned. Thus was born the idea of a 1½-stage rocket, to appear later in Atlas.

It was the Korean war that led to the renewal of work on the ICBM, and Convair were asked to undertake development. In Jan., 1951, a new project number was allocated—MX-1593. Nevertheless, there was still a good deal of opposition to the idea of a ballistic missile in this class, which seemed an impossible task for contemporary engineering.

Again, Convair were asked to consider the glide approach as



Comprising two jettisonable booster engines of 150,000-lb. s.t., and a central sustainer engine of 60,000-lb. s.t., this arrangement in the Convair Atlas represents the United States' most powerful existing rocket power-plant.

well as pure ballistics. In 1951, it was seriously doubted that a ballistic missile could be aimed with sufficient accuracy to destroy a target at a distance of 5,500 nautical miles (the range now demanded), and there was considerable doubt that a nose-cone could be adequately protected against severe frictional heating during re-entry. Indeed, to many Pentagon officials, the whole idea was nearer to science-fiction than solid engineering; and at times, it appears that Bossart and his team were virtually alone in their struggle.

It seemed to many people that there was something to be said for a glide missile that could be controlled all the way to a target, which it could approach from almost any direction. And, significantly, a glide approach would not involve such severe heating problems.

Although the Convair team worked steadfastly on both schemes, one factor was obviously in favour of the ICBM. The free-falling ballistic missile would be much more difficult to intercept than the glide vehicle, and once launched it would be impossible to deflect from course.

The ballistic approach would be more difficult to achieve. But in the end it would be the most effective method of delivering a warhead.

Thermonuclear Breakthrough

On Nov. 1, 1952, came the test of the first hydrogen-bomb in the Pacific and with it a reappraisal of the payload capacity of the projected ICBM. The prototype H-bomb was cumbersome in the extreme, requiring heavy refrigerating equipment, and the aim was to develop a "dry" bomb of the same energy-yield or even higher.

Then, on Aug. 12, 1953, Russian scientists also tested an H-bomb; and radiation sampling by the Americans indicated that their bomb was "dry." Although such a weapon was being developed in the United States, it had not yet reached the testing stage.† More than anything else, this focused attention on the ICBM, for it seemed obvious that Russia would now seek to harness the bomb in a long-range ballistic rocket.

Until a similar breakthrough could be achieved in the United States, an ICBM of the desired range and payload capacity involved a vehicle approximately 90 ft. long and 12 ft. in diameter. Five rocket engines with a combined thrust of 650,000 lb. were required for launching, and indeed a full-scale mock-up of such a missile was constructed by Convair in 1954.

But very soon the new thermonuclear warhead reduced the size and thrust to manageable proportions, and the present Atlas concept was born. The operational Atlas has an overall length of 75 ft., a diameter of 10 ft. and a three-engine propulsion unit with a combined thrust exceeding 360,000 lb.

One last thought remains. Had the Americans not waited for the thermonuclear breakthrough, which produced a lighter warhead, they would have achieved a rocket of nearly twice the thrust. In the light of subsequent events, this would have produced a rather cumbersome ICBM but, at the same time, a high-thrust booster eminently suited to space-research.

Russia's possession of heavyweight rockets capable of orbiting the 26-cwt. Sputnik III and launching 800-lb. Lunik probes suggests that the challenge of producing a super-ICBM may have been accepted in the U.S.S.R. before the lightweight/high-yield hydrogen bomb was perfected.

However, America has little to criticize in the Atlas ICBM. Not only has its efficiency as a ballistic weapon been proved in exhaustive tests but, in Dec., 1958, it secured an outstanding triumph when, stripped of its military equipment, it established its entire main structure in orbit and was used in a pioneer radio-communications experiment, Project Score.

Subsequently, the development of Atlas as a launching vehicle for the Mercury space-capsule has been proceeding apace, while its use for boosting heavy research payloads into space will be further enhanced by the addition of a LOX-hydrogen top-stage under the Centaur project. In all these developments, much credit is due to the diminutive MX-774 of more than a decade ago which showed the way to a new plateau of high performance in ballistic rockets.—K.W.G.

† This was achieved on Mar. 1, 1954, and confirmed the feasibility of a high-yield, lightweight, thermonuclear weapon suitable for a ballistic missile.

Launching Tiros I

AWAITING launching at Cape Canaveral is an important new satellite, Tiros I, which is regarded as the forerunner of orbital devices that, one day, will provide a comprehensive global weather information service. Launched into a near-circular orbit at 400 miles by a Thor-Able three-stage rocket the satellite is expected to have a lifetime of about 90 days.

Tiros I introduces a new shape in artificial satellites. It is roughly cylindrical with 18 flat sides and is approximately 19 in. high and 42 in. dia.; it weighs 270 lb. The sides and top are covered with solar cells, about 9,000 in all, which are mounted in groups of five on printed circuit boards; each "block" contains 80 individual cells. These serve to recharge a bank of chemical storage batteries.

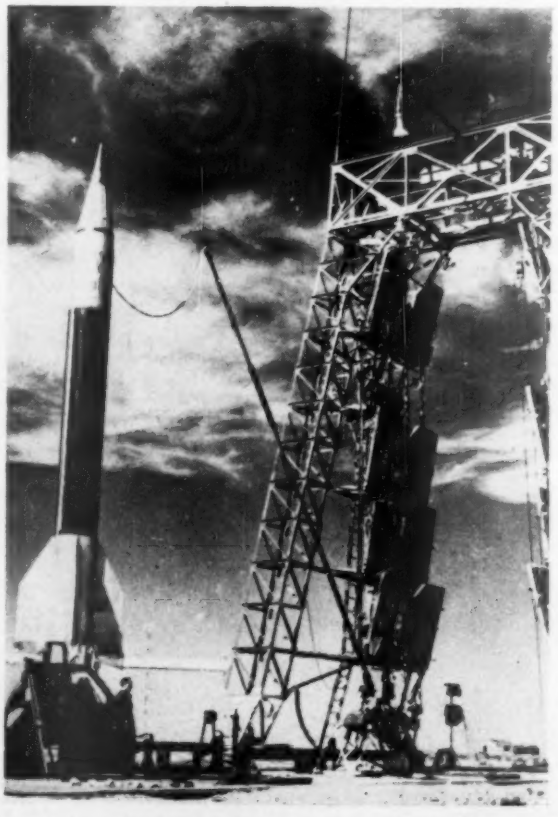
Protruding from the top of the satellite is a single telescopic antenna for the reception of command signals, while four antennae on the bottom serve for the transmission of data to ground stations. Two small TV cameras also protrude from the lower surface, one to scan cloud-cover over a wide band from 50° N to 15° S, and another to focus on a relatively small area within this field of view. Infra-red detectors are also fitted with the view to obtaining elements of a global "heat map."

The intention is to have Tiros I revolve on its axis at a rate of about 12 r.p.m., which involves reducing the initial spin of 120 r.p.m. inherited from the launching rocket. This will be done by releasing two weights attached to cables which extend radially from the satellite by centrifugal force. When the spin-rate is suitably reduced, the weights are released by firing squibs. At intervals of 20 days, small solid rockets mounted on the satellite's base-plate will be fired on command from the ground to maintain the spin rate.

Operating at about 18 watts, the satellite's electronics, which include facilities for taping, filming and communications, are designed to transmit information on command when the vehicle is within range of ground stations, a period of between six and 12 minutes. It is planned to use 3½ minutes of this time for the transmission of coded data and the remainder for pictures.

Tiros is being developed for the National Aeronautics and Space Administration by the Radio Corporation of America under the technical supervision of the Army Signal Corps' Research and Development Laboratory.

A second launching attempt is scheduled for August. The launching vehicle is similar to that which sent Pioneer V into orbit round the Sun on Mar. 11.



Preparing a Veronique upper-atmosphere research rocket for launching at the French Colomb-Bechar test-range in Algeria. The rocket climbed 125 miles.

Aviation News in General

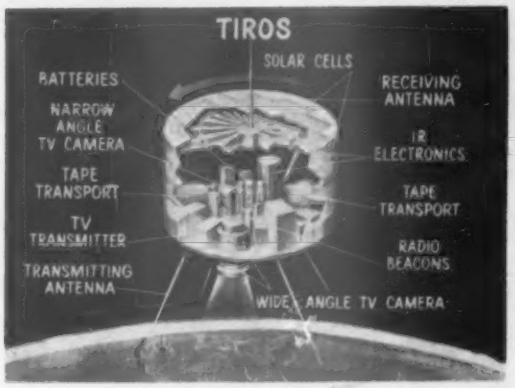
MYSTERY OBJECT.—The "mystery" satellite discovered in orbit over the poles is now believed to be the ejected capsule of Discoverer V launched on August 13, 1959. Radar analysis indicates that the object has a cross-section consistent with the 2 ft. by 3 ft. dia. re-entry body. The capsule apparently ejected in the wrong direction and is in orbit with an apogee some 500 miles higher than that achieved by its Agena launching rocket.

RAMJET SATELLITE.—A proposal for a manned "air-gulping," powered satellite has been made by Dr. S. T. Demetriades. Orbiting at a height of 60-70 miles, the vehicle would accumulate, liquefy and store air. Part of this would be used to power the satellite and the remainder to refuel outgoing space-vehicles.

MIDAS MISHAP.—Failure of the Atlas-Agena B (Midas) satellite on February 26 is attributed to the explosion of retro-rockets intended to separate the two stages. These ripped open the Agena propellent tanks and the self-igniting fluids mixed. Another launching attempt is scheduled.

EXPLORER FAILS.—An attempt to orbit a 35.3-lb. satellite, Explorer VIII, was forestalled on March 23 when an upper stage of the 4-stage Juno II launching vehicle did not ignite. Object was to investigate solar effects on the Van Allen radiation belts.

AEOLUS.—A new test rocket reached a height of 80 miles at Woomera on March 25. Known as Aeolus and designed by the Australians at WRE, Salisbury, the vehicle will be used in the upper air research programme planned by the National Committee on Space Research, Australian Academy of Sciences.



Artist's impression of the Tiros meteorological satellite (see page 412).

SNAP-8.—NASA are negotiating with Aerojet-General for the development of a new nuclear auxiliary power unit for space vehicles, SNAP-8, which will generate 30,000 W. of electrical energy and operate unattended for at least a year. A dual version providing 60,000 W. could be orbited using the Saturn booster.

NORD-BELL LINK.—Nord-Aviation has signed an agreement giving the Bell Aircraft Corporation an option to manufacture its supersonic CT-41 and subsonic CT-20 target missiles in the U.S.

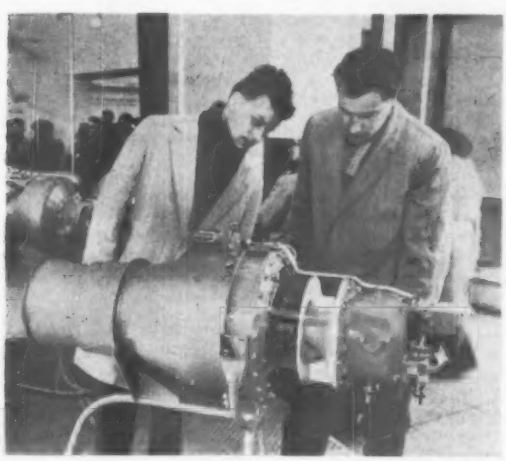
ELECTRONICS COUNCIL. — The formation of an Electronics Industry Council has been announced by the Electronic Engineering Association. It will be concerned with electronic instruments, sound and television transmitters, radio communication equipment, radar and radio navigational aids, computers, industrial electronic control equipment and industrial television and the electronic components used therein. The objects of the Electronics Industry Council are to promote and further the well-being of the industry in the United Kingdom; to provide a channel for communication with the Government, and to co-operate with other industrial commercial and mercantile bodies in the United Kingdom and abroad. It will deal with matters which concern the whole industry while its constituent bodies remain autonomous in their own fields of activity.

EJECTION OBSERVED.—Among the 29 air attachés from 26 nations who recently visited the Martin-Baker Aircraft Company was the Soviet representative, Col. F. S. Roumiantzev, in addition to other attachés from Eastern Europe, including Bulgaria and Poland. They were shown development films of the Martin-Baker ejection seats, and at Chalgrove saw a dummy runway ejection from a Meteor flown by Sqn. Ldr. J. S. Fifield, D.F.C., A.F.C.

NAVY AZTECS.—The U.S. Navy has ordered 20 Piper Aztec twin-engined lightplanes for communication duties. They will be designated UO-1.

MATERIALS CONFERENCE.—The London and Home Counties regional advisory council for technical education is organizing a conference on "The Selection of Materials" at the Brunel College of Technology on April 20. Speakers include Mr. F. F. Simpson of D. Napier and Son, Ltd., and Dr. H. Roberts of the Fairey Aviation Co.

HELICOPTER TOURISM.—Tourist helicopter flights over London are to be made between April 1 and October 31 by Executive Travel, Ltd. Using Westland Widgeons operated by Bristow Helicopters, Ltd., these tours will cost £5 10s. for an 18-19 mile flight or £3 3s. for a 9-mile flight.



PIRNA 017.—A small gas turbine produced by the East German aircraft industry is the Pirna 017, which is described on page 404.

Commercial Aviation Affairs

B.O.A.C. 707 TRAINING.—A total of 24 B.O.A.C. pilots and 21 flight engineers will be trained on the Boeing 707-436 at Tucson, Arizona, during April. Two, or possibly three, fully modified aircraft are to be utilized for an 18-hour period every day, with a 24-man B.O.A.C. servicing team maintaining the aircraft between midnight and 6 a.m. each day. The first 707 is expected in England at the end of April, with three more during May. One will be based at St. Mawgan for training, and route flying will start early in May. Transatlantic services will start in June provided there is no further delay in obtaining A.R.B. validation of the U.S. certificate of airworthiness.

FIFTH A.A. COMET.—The fifth Comet 4 for Aerolineas Argentinas, named "Alborado," left Hatfield on Mar. 19 en route for Buenos Aires.

CONWAY DC-8 APPROVED.—The Conway-engined DC-8 Series 40 was granted its F.A.A. type certificate last week, clearing the way for its operation by T.C.A. starting on Apl. 1. This version has a cruising speed of 515 knots at max. cruise thrust, a still air range of over 4,670 naut. miles and a required runway length of 9,750 ft. at 310,000 lb. gross weight. The Series 40 has also been ordered by Alitalia and C.P.A.

J.A.L. PICKS CONVAIRS.—As expected, Japan Air Lines has chosen the Convair 880/22M for its south-east Asia network and the new southern route to Europe. Government permission is being sought to buy three at a cost of $3.9 million each. One would be delivered in May, 1961, and two in June.

707s FOR EL AL.—Government approval is being sought by El Al for the purchase of two Conway-engined Boeing 707-420s (with an option on a third) for transatlantic service by July, 1961.

NORTH ATLANTIC TRAFFIC.—During 1959, the number of passengers carried by 17 IATA member airlines across the North Atlantic increased by 19.2% over the 1958 figure, to 1,539,934. At just over 40,000 short tons, freight traffic increased by 45.4%, and mail was up by 15.4%. Of scheduled passengers carried, 21.5% went first-class, 4.7% tourist and 73.8% economy. There were 3.1% fewer passenger flights but 6% more seats available. The overall load factor increased from 61.1% to 66%.

DAN-AIR EXPANSION.—On Apl. 4, Dan-Air Services will introduce the first of its new series of scheduled services planned for the 1960 season. The services are to be based on Bristol and will serve Cardiff, the Isle of Man, Liverpool, Gatwick and Basle. A service between Gatwick and Jersey will be introduced on June 18, and permission to extend to Plymouth is being sought. The Dan-Air fleet now includes three ex-B.E.A. and ex-Butler Ambassadors in addition to two Doves, two Dakotas, four Yorks and three Bristol 170s.

BIRMINGHAM HAND-OVER.—On Apl. 2, control of Birmingham Airport, Elmdon, is to be transferred from the M.o.A. to Birmingham Corporation. The occasion will be marked by a short ceremony at the airport at 11 o'clock followed by a lunch given by the Lord Mayor of Birmingham.

WORK AT L.A.P.—The work of extending the main 28L/10R runway at London Airport from 9,576 ft. to 11,000 ft. is to begin in May. From then until September, runways 10R and 05L will be available only for daylight operations, with some limitations, and the landing distance available on 10R will be reduced by 1,000 ft. From mid-September, for about six months, runway 28L/10R will be closed completely and improved runway lighting will be installed.

CONVERSION.—Allison-engined Super Convairs will be in service with Lake Central Airlines by the autumn. Flight trials with the prototype conversion began on Jan. 19; note the taller fin.

100th 707.—Air France received the 100th Boeing 707 on Mar. 18; 110 remain to be delivered on existing contracts. According to Boeing, the 707 is now serving 64 cities in 37 countries, has carried over 3,300,000 passengers and flown more than 160,000 hours.

PYE ILS AT EMBAKASI.—Following its selection for use at Leopoldville and Elizabethville, Pye ILS equipment is to be installed on the 13,500-ft. runway at Embakasi, Nairobi.

MIDLAND AIRPORT.—An expert survey is to be made to assess the possibility of converting Castle Donington airfield, Leics, into a major civil airport to serve Notts, Derbyshire and Leicestershire. The project is backed by the three county councils and by Nottingham city council and Derby town council.

MORE NOISE RULES.—Proceeding with its anti-noise regulations, the F.A.A. has proposed rules for Washington National Airport which will establish optimum altitudes and traffic patterns for minimum noise over built-up areas. The proposal is of particular interest since it applies only to piston-engined and turboprop aircraft; no turbojets operate at Washington National.

BLACKBUSHE CLOSURE.—The M.o.A. has announced that Blackbushe Airport is to be closed permanently at midnight on May 31, when all flying facilities will be withdrawn. The airport is closed this month for operations between midnight and 08.00 hours.

BERLIN CONTROL.—In future U.K. transport aircraft flying into or out of Berlin must have their flight-crew instructions approved by the Ministry of Aviation and must have ADF plus Decca, or ILS (capable of receiving the aural legs of VAR), or VOR.

F.A.A. APPROVES THE TYNE.—F.A.A. approval has been granted to the Rolls-Royce Tyne 506 (B.E.A. Vanguard), Tyne 512 (T.C.A. Vanguard) and Tyne 515 (CL-44D). All three have already been approved by the A.R.B.

NAVIGATORS COUNCIL.—The 10th Annual Convention of the International Airline Navigators Council will be held in New York on Apl. 19, 20 and 21.

News About People

Mr. G. B. G. Potter, B.Sc., M.I.Mech.E., F.R.Ae.S. has, as we have already recorded, been appointed managing director of Smiths Aviation, Marine and Industrial Divisions.

ICAO APPOINTMENT.—Mr. John Hutchison has been appointed ICAO representative for its European and African office in Paris in place of M. Lionel Bedin.

RECOGNITION AWARDS.—The Second Air-Britain National Aircraft Recognition Contest was held on March 12. The Silver Hunting Trophy for the highest scoring team was won by the Heston Branch of Air-Britain "B" Team (Messrs. J. Newton, B. N. Stainer, V. E. Gibb). Mr. Newton also received a special award presented to the highest individual team scorer. The B.E.A. Viscount Trophy for the highest individual scorer not in a branch team was awarded to Mr. D. M. Stroud.

K.L.M. POST.—Mr. John Turner-Lashmar has been appointed K.L.M. sales manager for the U.K. and Ireland. He succeeds Mr. Hans Bruening, who has been appointed marketing manager for K.L.M.'s eastern European services.

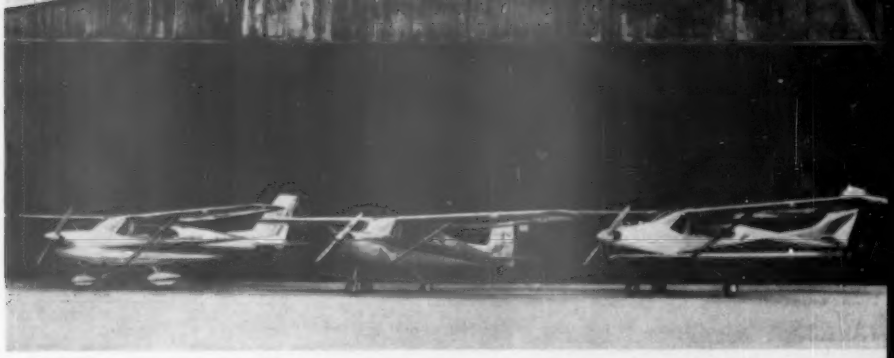
STEEL APPOINTMENT.—Mr. R. G. Tolley has been appointed director and general manager of Aircraft Steel Structures, Ltd., of Acton—one of the Simms Group of companies.

MARCONI APPOINTMENT.—Mr. S. G. Spooner has been appointed works manager of Marconi Instruments, Ltd., St. Albans, with responsibility for manufacturing activities, industrial relations, works services and welfare.

FIRESTONE CHAIRMAN.—Mr. A. D. Wenzel, who was appointed managing director of the Firestone Tyre and Rubber Co., Ltd., in England last July, has now also been appointed chairman.

SIR FREDERICK BOWHILL.—A memorial service for Air Chief Marshal Sir Frederick W. Bowhill, C.B.E., K.C.B., C.M.G., D.S.O., will be held at the Royal Air Force Church of St. Clement Danes in the Strand at 12 noon on Friday, April 8.

Personal Flying



CESSNA LINE-UP.—Airwork Services Ltd., the U.K. Cessna agents, are at present demonstrating three of the latest range of these American types, including the Model 175 (G-APYA), the 150 (G-APXY) and the 210, at Blackbushe.

The recent annual rally of the Aero Club of East Africa at Wilson airfield, Nairobi, marked the 33rd year of the Club's formation. Many famous flying names have figured in its history, and it continues to flourish, with a total membership of about 430 people. Some 50 or 60 of these fly regularly at Wilson, in the club's two Tiger Moths, a Chipmunk and a Piper Cruiser, which achieve a total of something like 1,400 hours a year.

Voluntary instruction is given by Messrs. J. le Poer Trench, Sven Frank, John Molloy and the Honorary C.F.I., D. O. Robson; as a result flying charges are fixed at the rates of 70s. an hour for the Tigers and Cruiser, and 80s. for the Chipmunk, dual or solo. If more than three hours in a month are flown on the Tiger or Chipmunk, and five on the Cruiser, the rates are reduced by 10s. an hour.

About 17 aircraft turned up for the March 6 rally, which included flour bombing, streamer cutting, spot landing, obstacle racing and other competitions, in addition to a handicap air race and the East African Powder Puff Derby. Joy-riding was performed by Cessna 180s and 182s of Campling Brothers and Vanderwal, Ltd., and the Kenya Police Air Wing staged an operational demonstration with their own Cessna 180s. These aircraft are very popular in Kenya, which is 5,000-8,000 ft. a.s.l. over much of its area, because of their excellent high-altitude performance.

Crazy flying was performed in a Tiger Moth by Sqn. Ldr. A. M. T. Noon, D.F.C., A.F.C., to such effect that at one time his wheels appeared to touch the hangar roof. The R.A.F. from nearby Eastleigh contributed some of its operational types, including a Beverley, and the Venom F.B.4s of No. 208 Squadron made a spectacular contribution to the display.

Current president of the East African Aero Club is Cecil J. Green, M.B.E., and the secretary is W. L. Hatton. Chief engineer is Phil Stone. Wilson airfield is adjacent to the Nairobi game park, and visitors can be assured of seeing a good deal of the local wild life. The aero club can offer residential accommodation, in addition to excellent meals, and has its own squash courts, lecture rooms and other facilities.

* * *

The American Federal Aviation Agency has announced that small, lightweight and low-cost Distance Measuring Equipment is soon to be available for U.S. light aircraft. A progress report submitted by the National Aeronautical Radio Corporation (NARCO) is being distributed by the F.A.A. Bureau of Research and Development to aviation electronic manufacturers; delivery of the first complete DME unit is expected by September, 1960.

Nineteen other units are expected soon afterwards, and when the equipment has been tested and pronounced acceptable, models will be made available to manufacturers engaged in building comparable apparatus. DME is in use in many larger aircraft and comprises a radio device which transmits electronic pulses automatically and continuously to a ground station. This then responds with signals which are presented to the pilot as direct distances of the aircraft from the station.

Gliding Notes

by Dr. A. E. Slater

AT R.A.F. Kirkbride, west of Carlisle, members of the "R.A.F. Wave Project" are still hoping for the Helm Wind to blow. This is a chill north-easterly wind which spills over the Cross-fell range in the Northern Pennines and pours down the south-west slopes as a deadly torrent into the Eden valley.

There it rebounds up and starts a train of lee waves, usually with one or more "rotors" underneath. The stationary cloud at the top of the first rotor has been known to many generations of farmers as the "helm bar."

On June 22, 1939, Noel McClean of the Newcastle Club was winched up into the upgoing side of the rotor at only 600 ft. above the valley floor, climbed into the wave above and reached 11,140 ft.—a British record. Four months earlier, I had received a letter from Dr. Joachim Küttner in Germany prophesying that 3,000 m. could be reached in the Helm Wave.

So when Gp. Capt. N. W. "Paddy" Kearon, vice-chairman of the R.A.F. Gliding and Soaring Association, was posted to take command of R.A.F. Carlisle, he set to work on the "Wave Project." Crosby-on-Eden, a disused airfield also under his command, was to have been the base, but a fellow-Irishman, Wg. Cdr. K. L. Monaghan, offered the use of Kirkbride airfield, a well-appointed place with a most co-operative traffic controller and directional radio.

Thus the main risk of wave-soaring in mountainous country was avoided—that of a low cloud layer closing in below the pilot so that he loses his bearings and does not know which part of the layer contains mountains.

The set-up was organized so that each of 11 different R.A.F. gliding clubs nominated suitable pilots who were prepared to spend part of their leave at Carlisle, not only at pre-arranged times, but any day at a moment's notice if a forecast of the Helm Wind was given by the meteorologists. Forecasts were not only obtained locally, but C. E. "Wally" Wallington at Dunstable was consulted on most days.

As it turned out, there were plenty of waves to exploit in other wind directions than north-east, and they proved almost as good as the Helm Wind. In fact, Gp. Capt. Kearon said he had seen good wave clouds in every wind direction.

He pointed out that Carlisle lies in a bowl surrounded by mountains except for the opening to the Solway. Even if the wind blows from there, a short tow to the south-east will take pilots to the lee of the Lake District.

By the time I arrived on the spot, some of the best wave flights had already been made—most of them in S.E. winds blowing from Skiddaw in the Lake District, which usually produced a wave over Wigton and others crossing Anthorn and the inner Solway, with sometimes an intermediate one over the S.E. border of Kirkbride airfield.

* * *

Things got really moving when Flt. Lt. "Lefty" Kurylowicz arrived with a Chipmunk to do most of the towing. On March 6 Gp. Capt. Kearon "air tested" three sailplanes and in one of them got up to 8,700 ft. in a N.N.E. wind from the Cheviots, although the forecast stated that waves were highly unlikely.

The big day was Mar. 10, with a S.E. wind in which John Williamson, on a third attempt in the Eagle, climbed with "Lofty" Eldridge from release at 1,700 ft. up to 10,400 ft., keeping more or less over Wigton all the time. Most of the climb was done at 5 ft. per sec.

From this point he saw lenticular clouds over the Lake District up to nearly twice as high, but the clouds had closed in below. With the help of direction-finding from Kirkbride, he emerged below them at 6,700 ft. near home. Williamson then went up with Gp. Capt. Goodbody to 8,000 ft.

Low clouds were down to 1,000 ft. by the time Kearon came down from the last of four flights in an Olympia 401. His radio battery had given out on the first flight, and this rather cramped his style.

More waves were found on the following days by these two and Flt. Lt. Dunn; and on Mar. 14 the Association's president, Air Chief Marshal Sir Theodore McEvoy, emerged below the overcast to find Kirkbride out of reach, so put down on Kingston airfield and was towed home from there. Needless to say, he made a normal landing, and the *Manchester Daily Mail* automatically came out with the headline: "Air chief crashes."

The day after I arrived, "Paddy" Kearon reached 7,800 ft. in the Olympia 401. There was a wave in the lee of Skiddaw and, in line with it, another in the lee of the Pennines; but he got his greatest height, not in either of these, but in a wave which linked the two and should not have been there, because the length of the Eden valley, not a mountain, was to windward of it.

Correspondence

Tale of Two Jennies

WITH regard to two letters published in THE AEROPLANE AND ASTRONAUTICS, being the letters from G. F. Smylie (Sept. 25, 1959) and S. H. Bostock (Oct. 16, 1959), which cuttings have just come to my notice by rather roundabout means, it so happens we have been checking information on the Curtiss JN-3 R.N.A.S. trainers Nos. 1362 and 1364 which were collected from Hendon after having fins fitted.

My father and Marsden flew these machines to St. Pol, Dunkerque, going via the Dover airfield. My father's engine blew up (pushed a con. rod through the crankcase) while over the Channel and he only just managed a forced landing on Gravelines beach.

Soon after the arrival of these Curtiss (Jennies) JN-3s at No. 1 Sqn. R.N.A.S., either Samson or Longmore ordered them to be burnt in gasoline in view of their unreliability. They were spirally unstable as you have probably gathered.

I have two small photos of the Curtiss JN-3s Nos. 1362 and 1364 which have been sent around to the experts to identify their engines properly, in fact this has been going on for months. At last we have that information corrected—they were Curtiss OX5 water-cooled Vee-8 90 h.p. engines. The cowlings appear to differ in my photos from that published in Thetford's book on Naval Aircraft.

I wonder if anyone can confirm that my father and Marsden ordered those fins fitted at Hendon; alternatively, I should have thought the job was done through higher authority. I ask this question because I am at present writing up some R.N.A.S. records, especially the cross-Channel flight mentioned above.

Going back to the letters mentioned above, I see reference to the Hon. Maurice Egerton having been sent to the States to pick up aircraft for the R.N.A.S. I heard that Commander Porter was sent over there as well for the same purpose, can you confirm the latter statement?

Tunbridge Wells. ROY C. MEATES.

Minimizing Bomb Damage

AS a way of solving the problem of bombs placed in passengers' luggage (THE AEROPLANE AND ASTRONAUTICS, Jan. 29, 1960), it seems to me that our aerodynamicists should look into the feasibility of designing a baggage "trailer" which could be flown at a distance sufficiently great to prevent an explosion from seriously crippling the aircraft. In such an event, the cable could be automatically released from the aircraft.

A device of this nature might be no more costly than the inspection procedures which have been suggested and, furthermore, instead of delaying the loading, it might actually speed it up, since such a trailer could be easily manœuvred right up to the airport baggage room.

Montreal, P.Q., Canada. R. G. POULIOT.

[Presumably our correspondent has in mind the proposals which have been studied for carrying nuclear power units in this way to overcome shielding problems. It is not easy to see ways in which the "trailer" could be handled without difficulty during take-off and landing.

Furthermore, M. Pouliot's proposition would involve re-stressing, re-testing and re-certificating all transport aeroplanes in service. And, when it had all been done, a passenger could still put the bomb in his pocket or his brief case!—ED.]

Fuels for Turbine-engined Aircraft

HOW timely was your leading article (Mar. 4) in which you commented on certain aspects of safety to which Lord Brabazon recently drew attention.

You referred to the late C. G. Grey's dictum that an aeroplane "should land slowly and not burn up." As a powerplant engineer I am much concerned with the "not burning up" aspect and have for some time been waging my own private campaign against the use of J.P.4 fuel (known also as "wide cut gasolene") in turbine-engined airliners. This is the fuel to which Lord Brabazon was presumably referring when he spoke of "petrol" being used in place of the more desirable kerosene.

The use of aviation gasolene, with its attendant dangers, has long been accepted for piston-engined aircraft, but with the advent of the kerosene-burning turbine engine, a new and improved standard of safety became available. An intermediate type of fuel, J.P.4, produced primarily for military considerations, was made available early in the fifties. Unfortunately this fuel is just as dangerous as gasolene and, in some respects, is more so. Some airlines have been tempted to use J.P.4 for reasons which are to me almost incomprehensible.

It would be as well to observe here that no fuel can be regarded as "safe," and it has often been pointed out that kerosene-fuelled aircraft have "burned just the same." Indeed they have burned, and when large volumes of fuel mist are generated in a crash, there is little to choose between the different fuels. The claim for kerosene is based not so much on its lesser proneness to ignite, but rather on its rate of flame spread when already burning. In this respect it is markedly safer than J.P.4 and gasolene. Within the scope of this letter it is not possible to consider fuel properties in detail, which is unfortunate, since there is widespread ignorance and apathy concerning this subject among people who build and operate aircraft.

Lord Brabazon, by so forcibly expressing his opinion and, by implication, that of the Air Registration Board, has performed a great service in the cause of safety. Some years ago, a representative of the A.R.B. publicly stated it as the Board's opinion that kerosene was the only fuel suitable for civil turbine-driven aircraft. It is satisfying to be able to infer that the Board are still of this opinion, but I am a little disappointed that their commonsense view has not become enshrined in British Civil Airworthiness Requirements.

Harpenden, Herts. J. W. RICKARD.

Roundabout

The Navy Line

If somebody, some day, compiles a book of classic aeronautical radio calls, the one made by a desperate senior pilot of 800 Sqn. couldn't be left out. He was practising aerobatics in a Seahawk when flying control heard him call: "Flame-out—inverted—down-wind." Their reply was equally epic: "Wait one." All ended happily—our hero landed safely, with just enough speed to turn off at the intersection.

*

Another glorious call was made by a Scimitar pilot putting on a display for some visiting brass: "I'd better do only one run—my port engine's on fire."

*

After watching, with dry lips and clenched toes, "Ark Royal's" flying operations with the formidable Scimitars and Vixens, I can understand why the Fleet Air Arm describe the (to me) highly fraught catapulted take-offs and arrested landings as "launching" and "recovery"—the same terms are used in missile testing.

*

I gathered, while mingling with 849 Sqn., that their hairy South African senior pilot, Lieut. Cdr. "Butch" Barnard, is thinking of transferring to a squadron which operates at greater heights than their Gannet AEW.3s.

*

A Miss is as good as her Smile. Flying back with B.E.A. from Gibraltar, I noticed our efficient stewardess was married and I pondered on the film-star convention which applies to stewardesses. Whether married or single, they are always referred to as "Miss" on the cabin address system and flight progress reports. Perhaps "Mrs." is too homely and un-airline?

*

From My Favourite Line Book

G.C.A. operator at Luqa, Malta: "Your range is 24 miles and there is a submarine on your port side. Can you see it?"

Valiant pilot, unimpressed: "What height is he?"

by Lorenzo

Industry Record

Jet Noise Suppression

A new company, Industrial Acoustics Co., Ltd., of 50 Mount Street, London, W.1, has been established in this country to produce noise suppression equipment for ground use with turbojet aircraft. It is a subsidiary of the American concern, Industrial Acoustics Company Incorporated of New York.

Of particular interest in the range of equipment manufactured by the company for controlling jet ground noise is the mobile lightweight multi-jet suppressor. This unit was recently tested on the twin Avons of a Scimitar by the Royal Navy. The National Physical Laboratory and two other independent observers recorded the acoustical performance of the unit and preliminary reports suggest that it achieved a good attenuation comparing favourably with that of heavier and less mobile units.

Control System Research

A new eight-amplifier computing unit has been supplied by Short Brothers and Harland, Ltd., to Queen's University, Belfast, for use in research by the Department of Aeronautics. Together with complementary computing equipment designed and made at Queen's, the new amplifier will be used in conjunction with other units and an oscilloscope to form a simple eight-amplifier analogue computer.

The Department of Aeronautics is engaged in research projects concerning various control systems. This new computing assembly will be of considerable assistance in this work.

Heat Treatment Plant Display

A fully working heat treatment shop will be exhibited in the Grand Hall, Olympia, to form the Gas Council's display at the Fuel Efficiency and Power for Industry Exhibition (April 27-May 6). The whole of the ground floor area of the Council's stand will be devoted to the heat treatment shop, in which all equipment will be fully instrumented. Above it, furnaces too large for inclusion in the exhibition will be displayed in model form in a lounge.

Working equipment will include a bright annealing furnace (The Incandescent Heat Co., Ltd.); high temperature oven (Thermic Equipment and Engineering Co., Ltd.); tempering oven, (J.L.S. Engineering Co., Ltd.); hardening and tempering salt baths (I.C.I.); and flame hardening machine for hardening spindles (Peddinghaus equipment by Surfard, Ltd.). In addition, there will be water and oil quench tanks and a hardness-testing machine.

ACCESS.—This multi-level servicing platform is one of four being supplied to B.E.A. by Mercury Airfield Equipment, Ltd. It has a capacity of 1,000 lb. and is infinitely adjustable in height from 7 ft. to 35 ft.

Industrial Television Display

Three-dimensional television for use in industry will be shown at the Instrument, Electronic and Automation exhibition opening at Olympia on May 23. Developed by Pye of Cambridge, this new 3-D system — particularly useful for remote observation, control and manipulation of materials and processes—can be attached to existing closed-circuit TV.

A Pye master slave manipulator can be used in conjunction with the new 3-D equipment for remote handling. The operator, having stereoscopic vision, can pick up any article by remote control. The three-dimensional effect is obtained by a mirror beam splitting system at the camera position and an arrangement of mirrors at the monitor end.

New Vibration Equipment

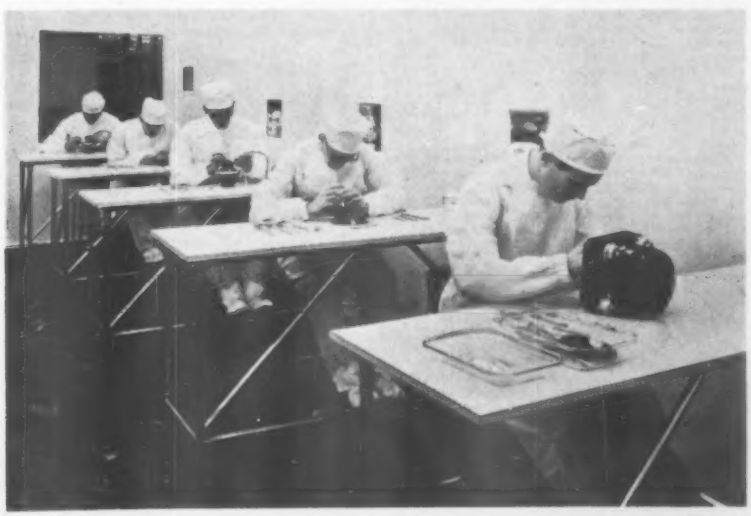
W. Bryan Savage, Ltd., have produced a new oil-cooled continuously rated vibrator with a maximum load of 10,000 lb. Of the moving-coil type and suitable for use in low temperature aircraft environmental test chambers, it can be employed in research, development and production work.

Facsimile Tape Recorders

A new series of facsimile tape recorders has been introduced by Muirhead and Co., Ltd. Intended for use at relay stations handling facsimile transmissions where direct relaying is impossible, this equipment stores signals which are retransmitted later when conditions permit. The recorders can also be used to store a received signal, simultaneously with its reception on a normal receiver.

The equipment takes the form of a self-contained console. The tape deck is mounted horizontally at a convenient operating height and is protected by a transparent lid. The operating controls—apart from those associated with the deck mechanism—are mounted on a sloping control panel.

These Muirhead facsimile tape recorders fall into two main groups. One is for the storage of picture signals and the other is for the storage of weather chart and document signals which are normally



CLEAN ROOM.—A recent innovation at Sperry's Brentford factory has been the provision of a new "super-clean" area for aero and marine instrument assembly. Initially, CL.11 Rotorace Gyros will be assembled in this area.

Industry Record . . . .

reproduced by a direct-recording process.

The tape recorders for weather chart and document signals are designed for automatic operation. That is to say, on receipt of the usual start signal from the transmitter the tape recorder starts, stores the signal and then reverts to standby completely automatically. On replay it is only necessary to start the tape recorder: at the end of the retransmission the tape recorder reverts to standby automatically.

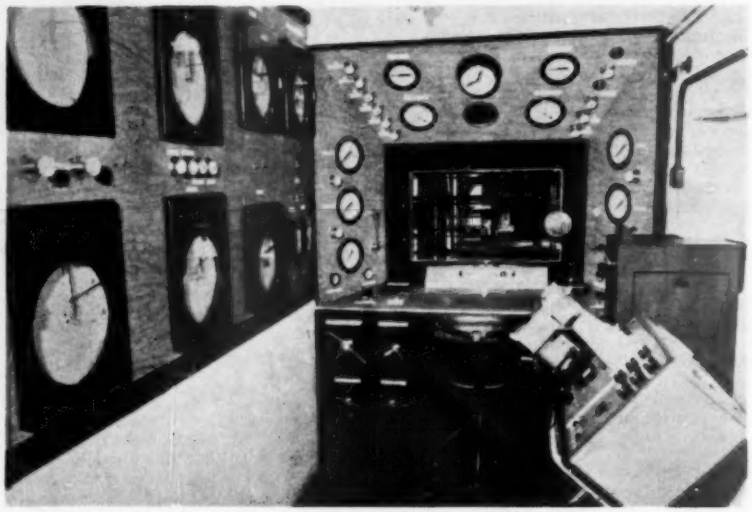
Anglo-American Electronics

Winston Electronics, Ltd., Shepperton, has become a wholly-owned subsidiary of the Dynamics Corporation of America, New York. Mr. F. W. Reynolds will continue as the chairman and managing director; Mr. R. Laurence, director of research and technical director; and Mr. J. Samuels as works director under long-term contracts. Mr. T. Anderson leaves the board.

The works at Shepperton are now being expanded to double the floor area and it is planned to double this again within the next two years; the number of employees will increase from approximately 200 to 800. Winston Electronics with its factory, engineering and research facilities will be the sales and manufacturing base in Europe for D.C.A.'s products, including tropospheric scatter communications equipment. In the United States, D.C.A. will increase its products with equipment designed and developed by the British company in the field of electro-medical units, electronic instruments and telecommunications systems.

B.O.A.C. 707 Equipment

Turbine speed and jet-pipe temperature control amplifiers on the Boeing 707s coming into service with B.O.A.C. later this year have been supplied by Ultra Electronics, Ltd. Incorporating Ultra magnetic amplifiers, this equipment is the first of its type to be engine-mounted. It has been designed to withstand high-level vibration and temperatures of 125°C. The company has also supplied the communication control system on the Corporation's 707 fleet.



NEW TEST RIG.—A new aircraft valve test rig installed by the Saunders Valve Co., Ltd. at their Hereford factory. Sensitive two-pen pneumatic recorders are supplied by Honeywell Controls, Ltd.

Aviation Calendar

Apr. 4

Amesbury.—R.Ae.S. Boscombe Down Branch film programme in the Lecture Hall, A. and A.E.E., at 17.30 hrs.

Derby.—R.Ae.S. Derby Branch lecture, "The Vickers Vanguard," by G. F. H. Hemsley, in the Rolls-Royce Welfare Hall, Nightingale Road, at 18.15 hrs.

Cambridge.—R.Ae.S. Cambridge Branch lecture, by Wg. Cdr. R. P. Beamont, in No. 1 Lecture Hall, Cambridge University Engineering Laboratories, at 20.15 hrs.

Milan.—(Apr. 4-8) 4th NATO AGARD Combustion and Propulsion Colloquium devoted to "High Mach Number Air-breathing Engines."

Apr. 5

Glasgow.—R.Ae.S. Glasgow Branch A.G.M., in the Royal College of Science and Technology, at 19.15 hrs.

Luton Airport.—R.Ae.S. Luton Branch lecture, "Guidance and Inertial Navigation," by E. G. C. Burt, in the Napier Senior Staff Canteen, at 18.15 hrs.

Salford.—Royal Technical College lecture, "Astronautics of the Future," by J. E. Allen, at the Royal Technical College, at 19.00 hrs.

Apr. 6

Christchurch.—R.Ae.S. Christchurch Branch lecture, "Supersonic Transport Aircraft," by Dr. R. G. Thorn, at the King's Arms Hotel, at 19.30 hrs.

London.—R.S.A. lecture, "The Hovercraft and its Place in the Transport System," by C. S. Cockerell, at the Royal Society of Arts, John Adam Street, W.C.2, at 14.30 hrs.

Reading.—R.Ae.S. Reading Branch A.G.M. and film show ("The Kitimat Story"), in the Top Canteen, Western Manufacturing, Ltd., at 18.00 hrs.

Swindon.—R.Ae.S. Swindon Branch lecture, "Experiences of an Airline Pilot," by Capt. O. P. Jones, in the College, Victoria Road, at 19.30 hrs.

Apr. 7

Cheltenham.—R.Ae.S. Branch A.G.M. and film show in St. Mary's College, at 19.30 hrs.

Coventry.—Main R.Ae.S. Lecture at Coventry Branch, "The Optimum Size of Rocket Engines," by J. E. P. Dunning, in the New Lecture Theatre, Herbert Art Gallery and Museum, at 19.30 hrs.

Cowes.—R.Ae.S. I.o.W. Branch lecture, "An Astronomer Looks at Space Travel," by A. F. Collins, in the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, at 18.00 hrs.

London.—British Interplanetary Society lecture, "Lunar Missions and Vehicle Design," by J. E. Allen, in the Tudor Room, Caxton Hall, S.W.1, at 19.00 hrs.

London.—Society of Instrument Technology lecture, "The Electronic Computor as a Unit in Air Automatic Electronic Data Processing Systems for Missile Trials," by W. C. J. White, at Manson House, 6 Portland Place, W.1, at 19.00 hrs.

London Airport.—R.Ae.S. London Airport Branch A.G.M. and Brains Trust, at B.E.A.'s Viking Centre Cinema, Halton Cross, at 18.00 hrs.

Apr. 8

London.—R.Ae.S. Rotorcraft Section lecture, "Experiences with an Operational Heliport," by R. A. C. Brie, in the Library, 4 Hamilton Place, W.1, at 18.00 hrs.

Company Notices

NEW COMPANIES

Air and Sea Motor Finance, Ltd. (650,722).—Private co. Reg. February 26. Cap. £100 in £1 shares. Directors: Harry Harris and Mrs. Monica B. Harris, both of 64 Main Road, Romford, Essex. Sec.: H. Harris. Reg. off.: 590 High Road, E.11.

Alghanim Transport and Engineering Co. (London), Ltd. (650,796).—Private co. Reg.: February 29. Cap.: £25,000 in £1 shares. Directors: Yusaf Ahmed Alghanim, P.O. Box 223, Kuwait, Arabian Gulf; The Rt. Hon. The Earl of Gosford, Portesbery Woods, Camberley, Surrey; Air Vice-Marshal Robert P. Willock; and Air Cdre. Sydney Smith. Sec.: T. A. Herbert. Reg. off.: Bond St. House, New Bond Street, W.1.

Alghanim Transport and Engineering Co. (Nigeria), Ltd. (650,797).—Private co. Reg.: February 29. Cap.: £10,000 in £1 shares. Directors: Dr. Jamil Nasir, 2 Dr. Johnsons Buildings, Temple, E.C.4; The Rt. Hon. The Earl of Gosford; Air Vice-Marshal Robert P. Willock; Air Cdre. Sydney Smith; and Yusuf Ahmed Alghanim. Sec.: T. A. Herbert. Reg. off.: Bond St. House, New Bond Street, W.1.

Specialised Aviation Services (Middle East), Ltd. (650,859).—Private co. Reg.: February 29. Cap.: £10,000 in £1 shares. Directors: Timothy M. Clutterbuck, 96 Piccadilly, W.1; Yusuf A. Alghanim; Air Vice-Marshal Robert P. Willock; and Air Cdre. S. Smith. Sec.: T. A. Herbert.

Specialised Aviation Services (West Africa), Ltd. (650,860).—Private co. Reg.: February 29. Cap.: £10,000 in £1 shares. Other particulars are similar to Specialised Aviation Services (Middle East), Ltd.

Wingair, Ltd. (650,871).—Private co. Reg.: February 29. Cap.: £100 in £1 shares. Objects: To carry on the business of forwarding and transport agents, etc. Directors: Albert E. N. Clarke, Camley Corner, Maidenhead Thicket, Maidenhead, Berks.; Ian A. Pearson, 41 Mayfield Avenue, Orpington, Kent. Sec.: W. M. Holdsworth. Reg. off.: Cargo Agents' Building, Central Area, London Airport, Hounslow, Middx.

R. F. Saywell (Sales), Ltd. (650,986).—Private co. Reg.: March 1. Cap.: £1,000 in £1 shares. Objects: To carry on the business of dealers in component parts for aeroplanes, etc. Directors: Ronald F. Saywell, Lowfield Place Lodge, Lowfield Heath, Crawley; Walter Watson, 168 Victoria Road, Horley. Sec.: W. Watson. Reg. off.: 39 High Street, Crawley.

Collin C. Simpson, Ltd. (651,075).—Private co. Reg.: March 2. Cap.: £1,000 in £1 shares. Objects: To carry on the business of charterers, ship, aircraft and insurance brokers. Directors: Collin C. Simpson and Mrs. Eileen Simpson, both of 26 Hurst Road, East Molesey, Surrey; Raymond G. Carter, 7 Downsway, Sanderstead, Surrey. Sec.: D. V. Robertson. Reg. off.: 26 Hurst Road, East Molesey, Surrey.

INCREASES OF CAPITAL

Dan-Air Engineering, Ltd. (545,942).—Bilbao House, New Broad Street, E.C.2. Increased by £15,000 in £1 ordinary shares, beyond the registered capital of £5,000.

Falcon Airways, Ltd. (616,038).—Waterloo Chambers, Fir Vale Rd., Bournemouth. Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £15,000.

Continental Air Transport, Ltd. (639,005).—Bucklersbury House, 3 Queen Victoria Street, E.C.4. Increased by £24,900, in £1 ordinary shares, beyond the registered capital of £100.

Personal Notices

BIRTHS

Batchelar.—On Mar. 16, at R.A.F. Hospital, Ely, to Pamela (*née* Love), wife of Wg. Cdr. Eric Batchelar—a daughter.

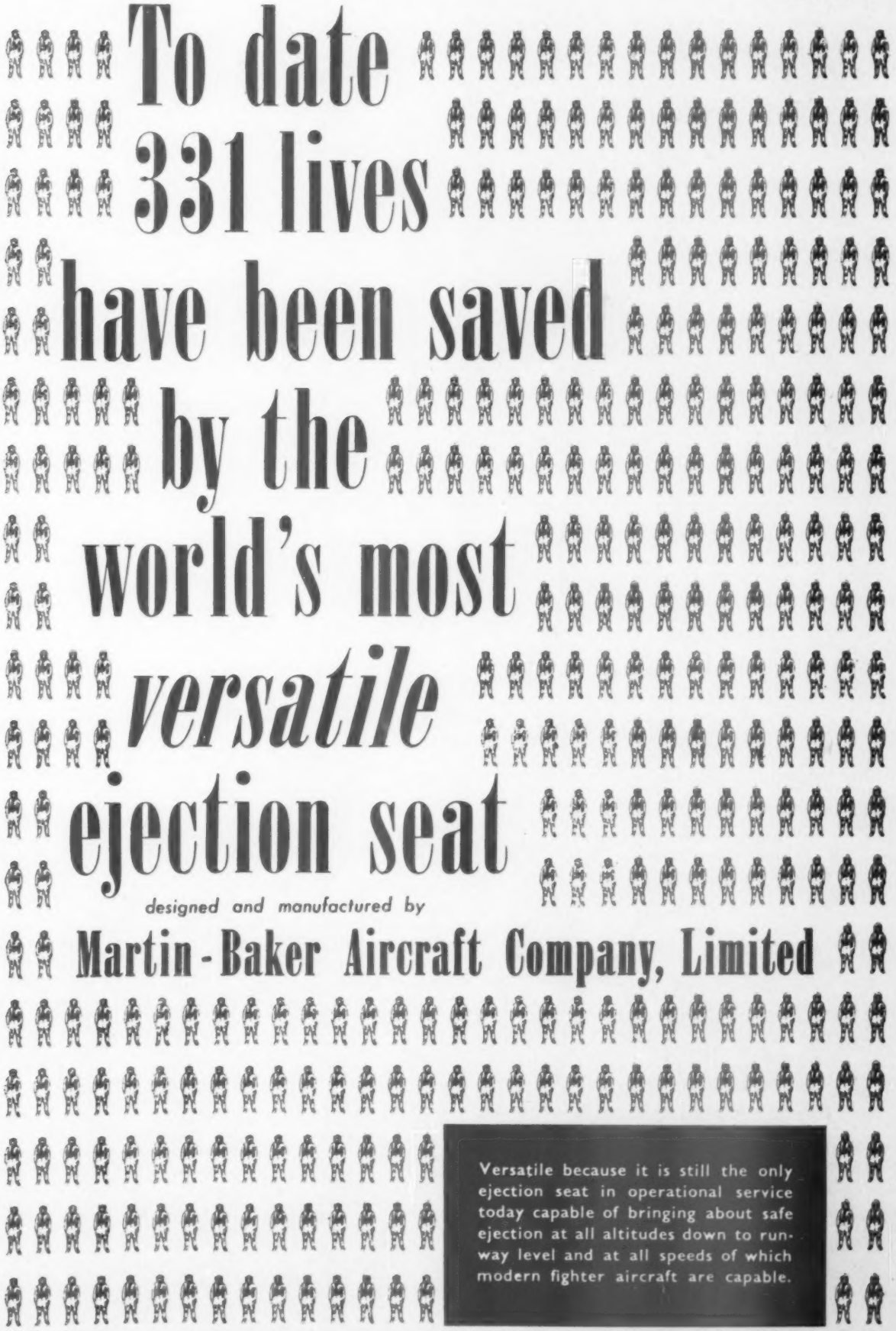
Blyth.—On Mar. 16, at R.A.F. Church Fenton, to Maureen (*née* Parker), wife of Sqn. Ldr. C. I. Blyth—a son.

Lang.—On Mar. 13, at Kilton Hospital, Worksop, to Jean, wife of Sqn. Ldr. K. R. Lang—a son.

Wain.—On Mar. 14, at R.A.F. Hospital, Wroughton, to Janet (*née* Kny-Jones), wife of Flt. Lt. R. M. Wain—a daughter.

MARRIAGE

Oldbury-Kennedy.—On Mar. 19, at St. Mary's Church, Shinfield, Gp. Capt. William Gordon Oldbury, O.B.E., D.F.C., R.A.F., to Elizabeth Cynthia Kennedy.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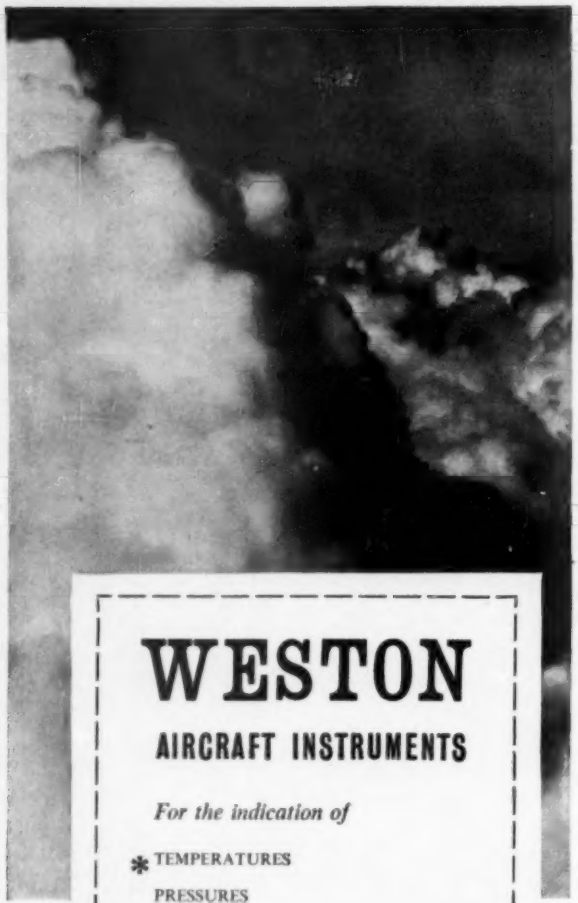

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44 Eglinton Av. West. Tel.: Hudson 5-4461

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401 Prudential Assurance Building, 94 Main Street. Tel.: 33-3048

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99 Rue de la Loi. Telephone: 12.00.05

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1956 PIPER TRI-PACER 150, airframe hours 1,060 since new, nil hours on engine since complete overhaul, dual control, full blind flying panel, engine silencers, navigation and landing ligh s, £3,300.

NEW 1960 CESSNA 150 2-seater, new Continental 4-cylinder 100 h.p. engine, dual control including brakes, VFR panel, clock, air temperature gauge, landing light, Narco Super Homer VHF radio with nine crystals, starter, generator, cabin heater, cigarette lighter, ashtrays, £3,945.

AUSTER Mk. V, Ref. 2546, Lycoming O-290-3 engine airframe hours 618, engine 338 since complete overhaul, dual control, full blind flying panel, engine silencer, starter, navigation lights, battery, generator, cabin heating, bench rear seat, long-rank tank, Ekco CE 1140 11-channel VHF, completely rebuilt by the manufacturers in 1956, C. of A. February, 1962, £1,795.

DON'T forget, if you wish to see aeroplanes like these available for immediate purchase, to visit the Shackleton Sales Week-end at Kidlington Airport, Oxford, on May 6, 7, and 8, 1960.

W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. Phone, Hyde Park 2448-9. Cables, Shackhud, London. 528-8

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GEMINI 1A with full dual control, MR80 radio, full night-flying equipment, modified Cirrus Minor 2A engines, Fairey Reed metal propeller, new cowlings, etc., and with certificate of airworthiness just renewed. Available for immediate sale or would exchange Chipmunk. Box A272, care of THE AEROPLANE AND ASTRONAUTICS. 529-8962

TIGER MOTH, engine hours 1,250, airframe nil since new C. of A., best offer over £350 secures. Lemerie, 41 Australian Avenue, Salisbury. 528-x4303

FOUR D.H. Dove Mk. 1B, full airline standard, excellent condition, available immediately from £9,000. Channel Airways, Southend Airport, Essex. Phone, Rochford 56480. 528-14

AUSTER Autocrat 3-seater with brand-new Cirrus Minor II engine, airframe only 660 from new and fitted dual control, 23-channel Murphy v.h.f. and long-range tanks, privately owned aircraft maintained in top-line condition by manufacturers, C. of A. to July, 1961, £1,475. Phone, Birmingham Springfield 1919. 529-x4372

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NOTICES

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM DERBY AVIATION, LTD., OF DERBY AIRPORT, BURNASTON, NR. DERBY:—

(a) APPLICATION NO. 2373/1; for permission to include an optional traffic stop at Ostend, on the Normal Scheduled service which they are at present authorized to operate with Dakota and Herald aircraft, on the route Swansea and/or Cardiff and/or Bristol-Luxembourg, at a frequency of 2 return flights weekly from April 1 to October 31 each year, until March 31, 1966.

(b) For the following Normal Scheduled Services, with Dakota aircraft, for the carriage of passengers only, for 7 years from 1961:—

(i) unless otherwise stated, for seasonal services from April to October each year, at an initial frequency of one return flight weekly, on each service, increasing later in accordance with traffic demand:—

APPLICATION NO. 3436; throughout the year on the route Manchester and/or Birmingham-Paris (tech.)-Basle.

APPLICATION NO. 3437; on the route Manchester and/or Birmingham-Luxembourg from April to September each year.

APPLICATION NO. 3441; on the route Manchester and/or Birmingham and/or Derby-Vichy (tech.)-Calvi.

APPLICATION NO. 3442; on the route Manchester and/or Birmingham and/or Derby-Vichy(tech.)-Albenga.

APPLICATION NO. 3443; on the route Cardiff and/or Bristol-Vichy(tech.)-Albenga.

APPLICATION NO. 3444; on the route Cardiff and/or Bristol-Vichy(tech.)-Calvi.

APPLICATION NO. 3446; throughout the year, on the route Manchester and/or Birmingham and/or Derby-Toulouse(tech.)-Palma.

(ii) at an initial frequency of 2 return flights weekly on each service increasing later in accordance with traffic demand:—

APPLICATION NO. 3440; on the route Bristol and/or Cardiff-Cork.

APPLICATION NO. 3447; for a seasonal service on the route Manchester and/or Birmingham-Perpignan, from April to October each year.

(iii) at an initial frequency of 3 return flights weekly on each service increasing later in accordance with traffic demand:—

APPLICATION NO. 3438; on the route Derby and/or Birmingham-Cork.

APPLICATION NO. 3439; on the route Manchester and/or Birmingham-Cork.

APPLICATION NO. 3445; on the route Manchester and/or Birmingham-Paris.

FROM CONTINENTAL AIR TRANSPORT, LTD., OF 3 QUEEN VICTORIA STREET, LONDON, E.C.4; for the following Normal Scheduled Services, initially with Viking aircraft and later also with Dakota aircraft for the carriage of passengers and supplementary freight, at an initial frequency of 2 return flights weekly on each service increasing later to 1 return flight daily, from May 1 to September 30 each year, for 7 years from 1960:—

APPLICATION NO. 3449 between Cambridge and Ostend.

APPLICATION NO. 3450 between Cambridge and Paris (Le Bourget).

FROM TRADAIR, LTD., OF SOUTHEND AIRPORT, ESSEX:—

APPLICATION NO. 3448; for a Normal Scheduled service with Viking and Viscount aircraft for the carriage of passengers, supplementary freight and mail on the route Southend-Frankfurt or Munich-Vienna at an initial frequency of 3 return flights weekly increasing later to 1 return flight daily, for 10 years from June 1, 1960.

APPLICATION NO. 3282/1; for an amendment to the terms of approval of the Normal Scheduled service which they are at present authorized to operate with Viking aircraft, on the route Southend-Bordeaux (tech.)-Seville-Agadir, at a frequency of 4 return flights weekly until September 31, 1966, so as to permit them to operate also with Viscount aircraft on the amended route Southend-Bordeaux (tech.)-Seville-Casablanca and/or Marrakesh until such time as conditions permit the service to be operated to Agadir.

FROM DON EVERALL (AVIATION), LTD., OF ELMDON AIRPORT, BIRMINGHAM:—

APPLICATION NO. 9/8; for permission to carry supplementary freight and mail on the U.K. Internal Service which they are at present authorized to operate with Dakota aircraft until September 30, 1966, on the routes (i) Birmingham-Guernsey (opt.)-Jersey at a frequency of one return flight on Saturday from May to September each year increasing to two return flights on Saturdays in July and August each year and (ii) Coventry-Birmingham (inward only)-Guernsey (opt.)-Jersey at a frequency of one return flight on each Friday and Saturday from mid-June to mid-September each year increasing to two return flights on each Friday and Saturday in July and August each year.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 528-1

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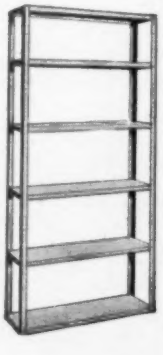

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